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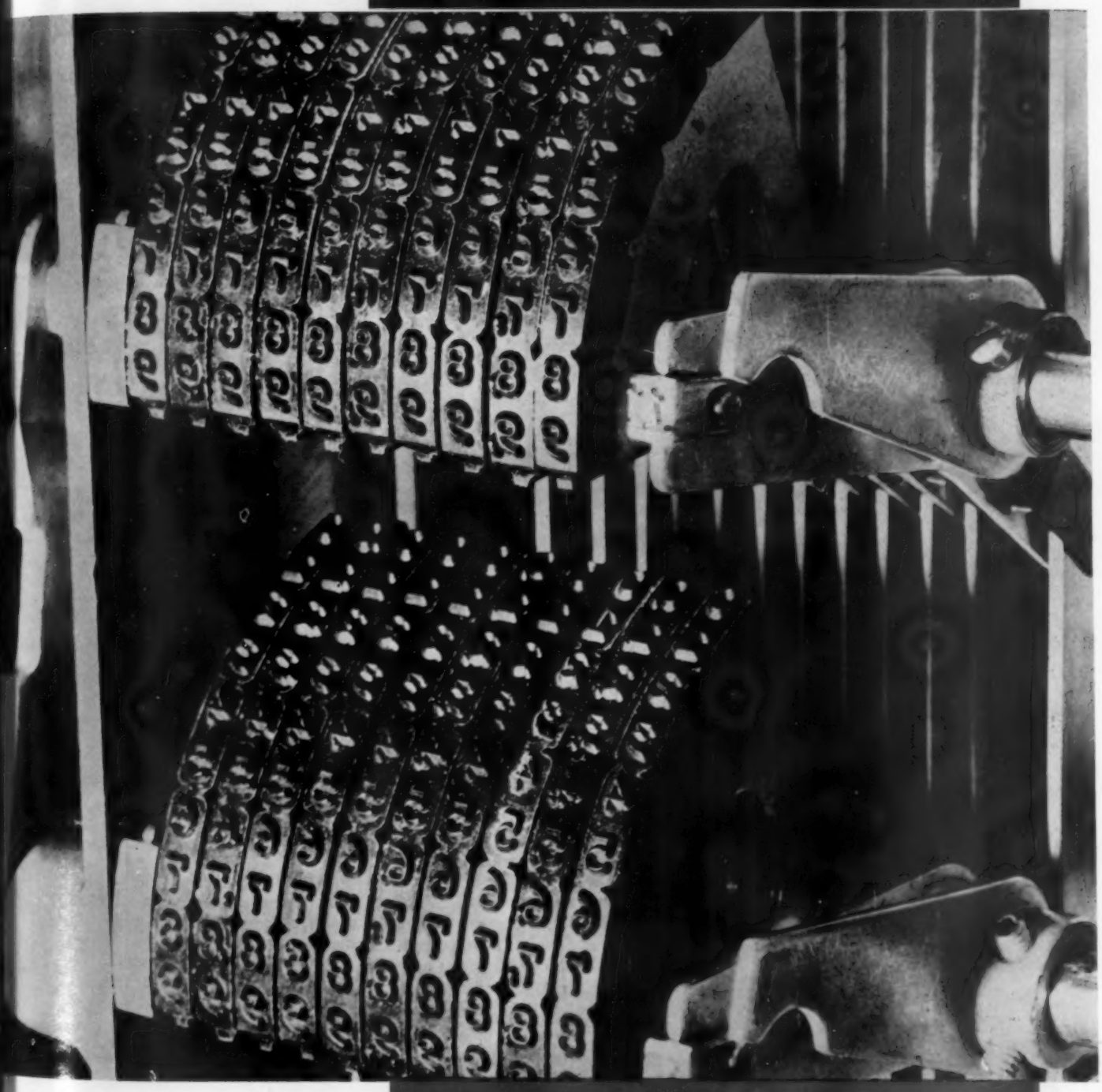
PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING



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See feature story/page 646

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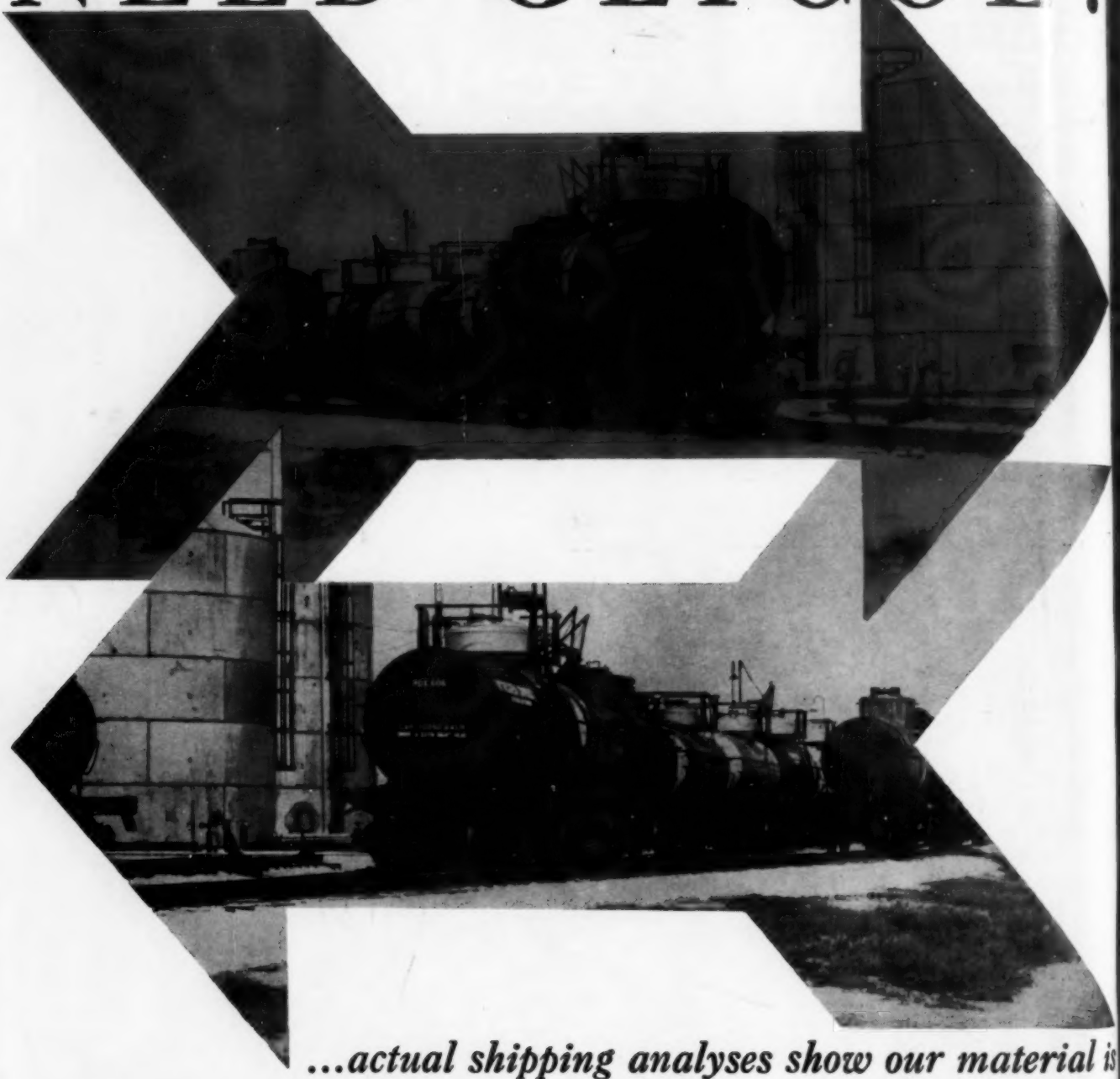

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PLASTICS TECHNOLOGY

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OCTOBER 1956

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Letters to the Editor

Small Coating Units Wanted

Dear Sir:

Can you give me the names of one or more makers of a device to sheet hot melts or cold (solvent-released) compounds of a tacky nature? Something considerably smaller than the large industrial type of equipment, but larger than the "Bird Applicator" which I understand is for miniature sized sheets.

We have written to the list shown under "knife spreaders" and "sheeting devices" in Thomas' Directory, but their equipment is all of the large industrial type.

We would like something to make sheets the equivalent of a yard or two square, assuming such would maintain a uniform thickness within at least five mils. The sheeting should stay between 35 and 40 mils.

V. Edward Baker
Elyria, Ohio

(A list of possible machinery sources has been sent to Mr. Baker. Can our readers offer further suggestions?—Editor)

• • •

Preserving Coins in Cast Resins

Dear Sir:

For the past five years, I have been experimenting with the preservation of coins in cast resins with excellent results. This method is suited for exhibitions, paper-weights, and ornaments.

Would you please forward this information to Mr. Sopata (Letters to the Editor, August issue, page 503) in event he may be interested.

Eddie Greene
Akron, Ohio

(This information has been forwarded to Mr. Sopata.—Editor)

• • •

Plastic Cocoon Coverings

Dear Sir:

There is on the market a liquid plastic material which, when blown from an air gun, hardens into a continuous, thread-like filament. This material is sometimes used to enclose objects in a cocoon-like covering for preservation and protective purposes.

We are also interested in a possible combination of two or more materials which, when ejected in a cold state (combined either just before or after ejection), will harden instantly to form a continuous thread.

We would greatly appreciate your supplying us with the names of these materials and their manufacturers.

Arthur Dritz
John Dritz & Sons,
New York, N. Y.

(Can our readers offer any assistance in this matter? A reply has been sent to Mr. Dritz, but more sources of supply are desired.—Editor)

• • •

Foam Rubber Coating

Dear Sir:

In reference to the letter "Wants Foam Rubber Coating" in your September issue, we would like to give the name and address of our company as a supplier of Hypalon and neoprene-base protective coatings.

In our experience, we have found that the Hypalon coating is well suited to coat natural foam rubber and offers besides waterproof surface, a wide variety of colors and chemical resistance.

G. Hastings
Montgomery Bros., Inc.
Essington, Pa.

(This letter has been forwarded to the original inquirer.—Editor)

• • •

Suggests Liquid Polymer Coating

Dear Sir:

On page 567 of the September issue, we noticed in the Letters to the Editor column one item of interest to us. The item pertained to a coating that could be applied to foam rubber. Products based on one of our raw materials may be of some interest in this application.

A number of our processors, such as Minnesota Mining & Mfg. Co., Coast Pro-Seal & Mfg. Co., Products Re-

search Co., and Presstite-Keystone Engineering Products Co., make compounds from our liquid polymer Type LP-2 that can be used for coating metal and other materials. It may be that they have something available for the type of application described in our column.

I am enclosing our technical brochure on the liquid polymers, and I trust you will find this of considerable interest.

D. E. Fish, Asst. Sales Mgr.
Thiokol Chemical Corp.
Trenton, New Jersey

(This letter, in complete form, has been forwarded to the original inquirer.—Editor)

• • •

Plastic Coating Wanted

Dear Sir:

We are currently in need of a plastic coating which could be applied to steel sheeting as well as wood panels. We prefer a material which would dry or cure at room temperature. A vinyl material would be acceptable.

Would you be kind enough to supply us with sources of such a material so that we might contact them?

(Identity Withheld)

(Suggested sources of supply are invited for transmittal to the inquirer.—Editor)

• • •

Wants Thin, Clear Mylar

Dear Sir:

In my work, I need some very thin, clear Mylar. If possible, can you give me any sources of supply for this material?

Warren Chester
Costa Mesa, Calif.

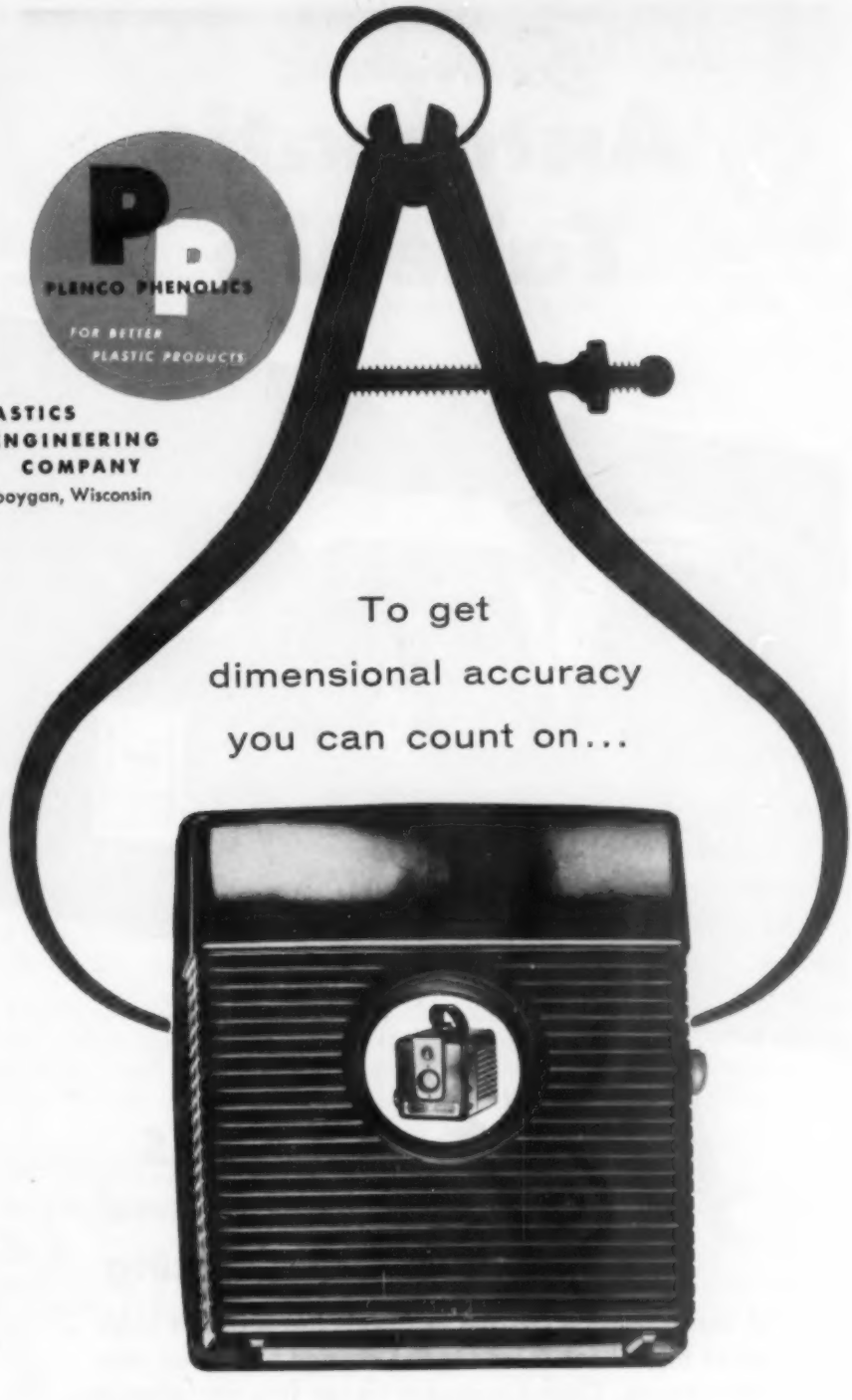
(What suggested sources of supply can our readers offer for transmittal to the inquirer?—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

—The Editor



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THE SHUTTER winks. In the interval, a panorama of surging action may be imprisoned within the camera housing. Plenco's phenolic engineers work with the knowledge that the precision operation of cameras, digital computers and other delicate instruments reflect the accuracy of their production. Plenco phenolic molding compounds have been developed and proved for this purpose. Their dimensional accuracy is but one of the excellent properties you can count on with Plenco.

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

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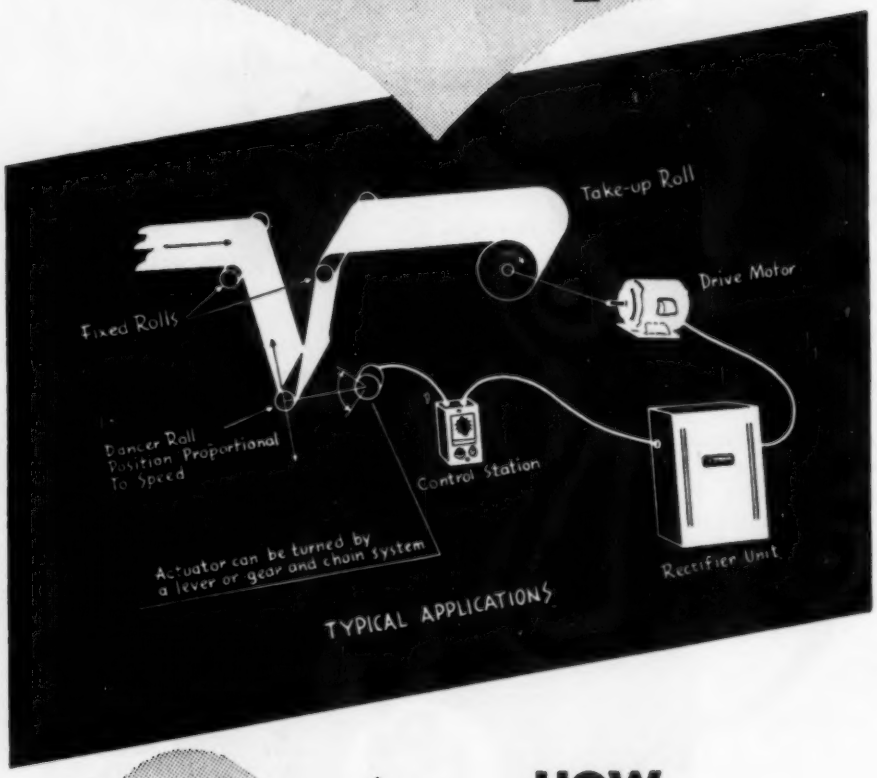

Here's HOW IT WORKS ...for Textile and Plastics Processing

A small tension change positions the actuator shaft so as to call for motor speed change to restore preset tension. Thus a constant linear feet per minute windup may be achieved even though the radius of takeup roll increases with each turn to otherwise increase linear speed versus radius build-up. Speed is now made proportional to position of dancer roll and tension is held essentially constant, as is the linear rate of material travel.

These and other models of electronic motor speed control systems available from 1/50th to 2 horsepower.

WRITE

Servospeed
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"Quote . . . Unquote"

Plastics in Automotive Uses

In terms of pounds, the amount of plastics of all types used in today's automobile is astonishingly small. It will only average 10 pounds of material per car in 1956. This is approximately 0.03% of the gross weight of the average family automobile.

"Here is a real challenge for the polymer chemist. We know the market exists, and we know what is required to capture a substantial percentage of this market. Economic trends are entirely favorable to a hundredfold increase in plastic sales for automotive uses if polymers having the required physical properties are provided.

"In mechanical applications, particularly, most of the plastic parts in use today are small in size and secondary in function. We must start thinking in terms of major components having primary functions. An experimental carburetor fabricated entirely from nylon performed well when tested on a small utility engine. There is no sound technical reason why the largest automotive carburetor could not be made the same way. Timing gears, transmission gears, and similar components fabricated from nylon have operated successfully in a five-horsepower garden tractor. No great imagination is required to visualize improvements in existing polymers to permit the design of similar components for passenger automobiles.

"We could conceivably mold one-half of a front or rear seat of an automobile in a matter of minutes, perhaps even completely upholstered as it comes from the die. Surely one day we will be able to injection mold a door panel, a trunk door, or an entire hood as a one-piece unit. As new polymers are developed and new fabricating techniques are perfected, these things will surely become practical, and they will bring more automobile and a longer lasting automobile for our purchasing dollar."

William C. Wall, Mech. Consultant
Polychemicals Dept.
E. I. du Pont de Nemours & Co.
Wilmington, Del.

Plastics in Transportation

"As long as the transportation trend is towards the automobile and aircraft industries, it appears quite certain that more and more plastics will be utilized in transportation.

"There will be misuses of plastics even though the automobile and aircraft industries are doing extensive testing to select plastics carefully, but in the long run transportation will be safer, faster, more economical, and more enjoyable because plastic materials have been used."

K. K. Fligor, Plastics Section
Goodyear Tire & Rubber Co.
Akron, Ohio

NEWS in BRIEF

Unfair trading practices of plastic materials suppliers are inveighed against by G. S. Nalle, Jr., president of Nalle Plastics (see guest editorial, pages 657-8). These include excessive credits to some molders, unannounced and unpredictable price rises on materials, and behind-the-scenes practices that set molder against molder. He argues a 10% discount on material prices for molders who pay their bills, and calls for all molders to unite so that their rights will be respected.

Plastic pipe sales, now at $45-million per annum, will double in volume by 1960, according to John Halvorsen of Orangeburg Mfg. Co. Presently available in four types - butyrate, rubber-resin blend, PVC, and polyethylene - the successful applications of plastic pipe have resulted in a sales growth of 900% since 1948. New resins will bring new applications of the pipe.

Plastics structural sandwich panels are being studied by M.I.T. in a program designed to meet the building industry's need for design and engineering, cost, and applications data on the panels. With greater emphasis on prefabrication in building, the panels have become important contenders to the traditional materials of construction.

Company developments include corporate name changes, new trademarks, company acquisitions, and potential mergers. Emet Plastics Corp. is the new name for Emet Vacuum Forming Corp. Nicolet Industries has purchased Modigliani Glass Fibers, Inc. A new company, Norwalk Plastics, has taken over the plant and assets of Lincoln Plastics Corp. Maraset, a new trademark for its line of epoxy resins, has been adopted by Marblette. Plastics extruders Vi-Plax Products Corp. and Garrison Co. were purchased by Reeves Brothers, Inc. Reichhold has entered three new fields; petrochemicals, melamines, and plasticizers. Wikkerink Co., makers of molded vinyl electrical carpets, was acquired by Republic Industries. Union Carbide is negotiating the purchase of Visking.

Rigid PVC sheets are the subject of a new commercial standard issued by the Department of Commerce. The standard, CS201-55, covers properties and test methods for both normal and high-impact sheets suitable for fabrication into equipment and structures by hot forming and plastic welding techniques.

Plastic company expansions in the news include Dow's plan to increase its Louisiana division investment to $50-million; the dedication by Koppers of a new chemical development lab in Kobuta, Pa.; the opening of a new plant in Huntingdon Station, N. Y., by Lunn Laminates; the addition by Modern Plastics of a new plant in Miami, Fla.; the expansion by Plastic Molders Supply into a new branch office and plant in Sandusky, O.; and the opening of a research and tech service lab for Reichhold, adjacent to its Elizabeth, N. J., plant.

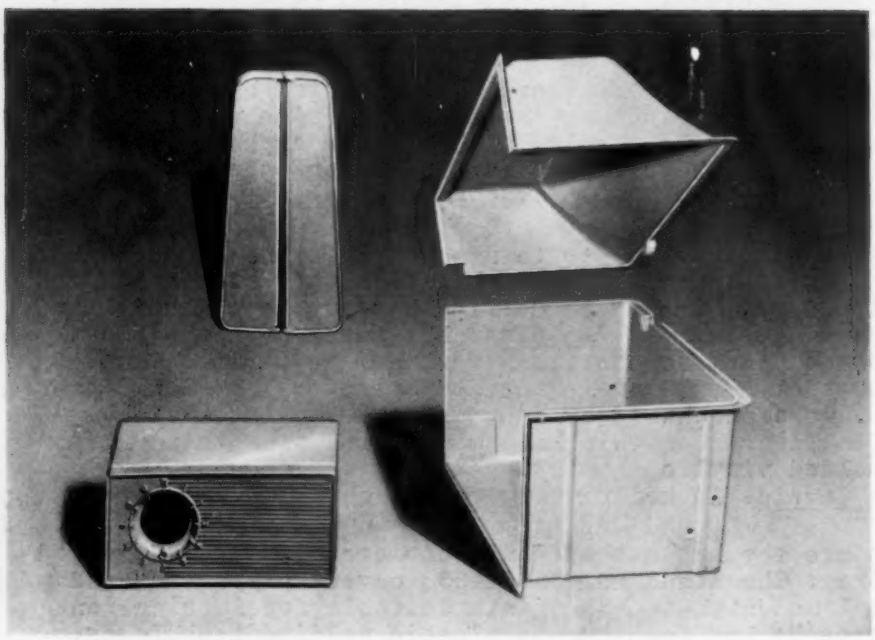
New Materials to be noted (see page 677): plasticizer intermediate; two modified-styrene molding compounds; spray finish for plastisols; lacquer for butyrates; glass-reinforced nylon molding compound; polysulfide liquid system for making flexible molds; plasticizer-dispersed colorants; thickener and dispersant for acrylics; antioxidant for hydrocarbon resins; mineral and flock-filled phenolic molding compounds; and universal spray finish for all plastics, except cellulose acetate.

New Equipment of special interest (see page 680): centrifugal molecular still; injection molding machine; dielectric ovens; hydraulic lift table; threaded stud inserts; and infra-red heating units.

New Products worthy of mention (see page 682): Orlon-surfaced reinforced plastic boat hull; acrylic signalling flashlight; laminated vinyl tableware; rust-preventive aerosol spray for molds; heat-sealable polyester film; polystyrene display box; epoxy adhesive kit; Teflon-coated metal foils; laminated phenolic sheets for electrical applications; nylon piping; thin, cementable Teflon tape in continuous rolls; rubber-phenolic roller skate wheels; and cushioned vinyl seat covering material for autos.

Plastiatrics
DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

THE IMPORTANCE OF CONTROLLED PRESSURE IN PLASTICS MOLDING



Recent developments in controlling plastics pressure have made it now possible to mold large, complex shapes, such as the radio cabinet, refrigerator liner and luggage end caps.

The disposable cup exemplifies the uniform quality product now demanded of materials and processes in fully automatic, high-speed molding. These cups were molded from Styron 689, a new general purpose formulation with greatly improved properties of easy flow.

AMERICA'S FIRST FAMILY OF POLYSTYRENES

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- STYRON 665 (Extrusion)
- STYRON 688 (Easy Flow)
- STYRON 689 (Easy Flow)

HIGH IMPACT
- STYRON 475
- STYRON 429 (Extrusion)
- STYRON 777 (Medium Impact)
- STYRON 440 (Heat Resistant)
- STYRON 480 (Extra High Impact)

HEAT RESISTANT
- STYRON 683
- STYRON 700

A CONTINUING REPORT

Results of Dow Plastics Technical Service research will appear in these pages from time to time. For a complete summary of Dow products and services, write: THE DOW CHEMICAL COMPANY, Midland, Michigan—Plastics Sales Department PL 429E.

INJECTION MOLDING RESEARCH SHOWS WAY TO BETTER TECHNOLOGY

In the continuing Plastiatrics studies under the direction of Dow Plastics Technical Service, one of the most rewarding areas of investigation for meeting more exacting needs today has been in the control of plastics pressure.

Beginning with the remarkable results of the early "pinpoint gate", considerations for equalizing pressure distribution in the molding system have assumed greater importance. Mechanical aids, such as the "free-flow" and "ball-check" nozzles, were adopted. Thermal studies on the effect of mold heats have made die temperature control units commonplace. Later findings that pressure control is directly related to the accuracy with which granules are fed to the heating cylinder led to the adoption of weigh feeders and pre-plasticizers for top efficiency.

Currently, the heating cylinder itself is a subject of widespread investigation for better conservation of pressure. Studies point to the fact that more efficient designs will greatly improve performance of the molding process. Meanwhile, at Dow the size, shape and treatment of plastic granules to conserve pressure loss have become important considerations in their manufacture. In Styron® (Dow polystyrene) alone four different granulations are offered with or without surface treatments to provide the molder unparalleled versatility in meeting design requirements.

The practical benefits of continuing Plastiatrics studies, such as those on pressure control, result in leadership. In Dow plastics you will find the better quality of materials more meaningful because they are realistically designed to perform for you. Ask for your copy of "Injection Molding Research Today and Tomorrow" or get in touch with your Dow representative for more complete information.

you can depend on
DOW PLASTICS

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PLASTICS TECHNOLOGY

Maintenance Welding in the Plastics Industry—Part I

Leon D. Richardson was born in Missouri in 1915, but spent his childhood and youth in California. He attended the University of Kansas and the Santa Monica (Calif.) City College, but learned welding engineering and metallurgy through self-study and practical experience. His industrial experience included work with Ford, Bacon & Davies, engineers; Stone & Webster, engineers; Merril Stevens Drydock; California Shipbuilding Corp. (1938-1939); W. A. Bechtel Co. (1939-1940); St. Johns River Shipbuilding Corp. (1941-1942); and J. A. Jones Construction Co. (1943-1945). He joined Eutectic Welding Alloys Corp. in 1945 where he is now the sales manager for the eastern states. In addition, he is sales manager for eastern Canada for the Canadian subsidiary, Eutectic Welding Alloys Co. of Canada, Ltd.

Mr. Richardson has presented more than 800 lectures before various technical societies, and has published many articles on welding. He has performed welding consulting services for the Armed Services and other government agencies, and for many universities. During the war, he was chief welding engineer for the prime contractor on the Oak Ridge atomic bomb plant construction project. He has demonstrated modern welding techniques in every city of over 20,000 population in this country and Canada.

Mr. Richardson is a member of the American Welding Society, Canadian Welding Society, American Society for Metals, and the New York Sales Executives Club. He makes his residence in Huntington, N. Y., with his wife and daughter.

The first of a two part article on how effective maintenance welding can reduce operational costs and capital investment.

L. D. RICHARDSON, *Technical Information Service, Eutectic Welding Alloys Corp. Flushing, New York*

THE plastics industry is reported to be one of the three fastest growing industries in the United States and Canada. A tribute must be paid to the plastics engineers who have made the great expansion of the plastics industry possible through better molding techniques, improvements in equipment for mass production of plastics, and increased general scientific knowledge. It is reported that the use of plastics today exceeds that of all metals, with the exception of steel.

Rapid growth in any industry brings problems of maintaining equipment. It is difficult for a new industry to develop maintenance techniques at the same rapid pace as its production techniques. Today, with the dire need for more and more production at lower and lower cost, a new significance must be placed upon effective maintenance methods. It costs upwards of a million dollars today to equip a plastics factory built along modern lines. Engineers are obligated to utilize every ingenuity to maintain the costly equipment in order to justify to management for such costly capital investment. Today, when replacement parts seem to cost more each month, salvage of every part possible is to

be desired. In addition, each year brings higher and higher labor costs so that loss of production and down-time become increasingly undesirable.

Use of an effective maintenance welding program offers at least a partial solution to the problem of high operational costs in a plastics plant. Most of the larger and many of the smaller plastics plants have today found welding maintenance to be capable of saving thousands of dollars in worn, broken, or damaged equipment, and to save countless hours of down-time.

Most plastics factories, both large and small, possess welding equipment as a maintenance tool. The greatest shortcoming in plastics plant maintenance welding currently appears to be a lack of reliable information on which parts can be repaired, together with lack of knowledge as to the value of repair by welding, and a lack of experience in the fullest utilization of maintenance welding. Engineers are familiar with the disadvantages of old welding techniques which required welding operators of great skill; necessitated the use of high heat which caused warpage, stress, and damage to the base metals; and, at best, were only "hit or miss" procedures.

Actually, the welding industry has now provided new techniques and procedures which have not only greatly simplified welding, but have made it almost completely foolproof as well. The purpose of this article is to describe these new welding techniques, and focus attention on how they can be utilized in the plastics industry to effect savings of such proportions that management cannot afford to overlook them.

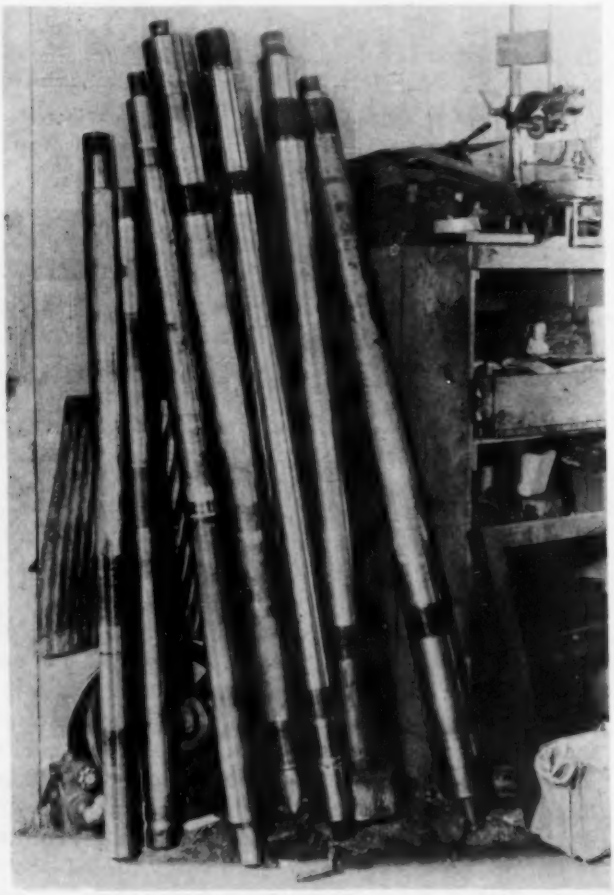

Fig. 1. Seven strain bars, which failed in service, after repair by welding.

By tradition, the term "welding" implies the crude melting together of two or more metals. This process, which is as ancient as Sanskrit, requires high operational heat; at least the melting point of the metal. This high heat results not only in high welding costs, distortion, residual stresses, undercut, and brittleness in the part being repaired, but also in porosity, cracks, and poor machinability in the weld metal. The fusion processes of joining metals require great skill and talent on the operator's part; even then, they often end in failure.

The Eutectic "Low Heat Input" Process

A new metal-joining process, most adaptable to plastic plant maintenance, has been found which minimizes and often completely eliminates the aforementioned obstacles. This new process has been proved sound, and offers numerous advantages over fusion welding, blazing, or soldering. The almost phenomenal success of the process is based upon new filler metals which are utilized with any standard metallic arc welding machine or oxy-acetylene torch, and are commercially available from my company under the trademark, Eutectic "Low Temperature Welding Rods." The filler metal alloys required are of proprietary nature and are covered by 62 U.S. and foreign patents.

The "Eutectic" process is the culmination of over 50 years of continuous research in metal joining. The late J. P. H. Wasserman, a Swiss metallurgist, organized a laboratory in 1904 to study certain unexplained phenomena in the reactions of combinations of metals and chemicals when exposed to thermal energy. As his work progressed, he was joined by other scientists including his son, Rene D. Wasserman, who organized the Eutectic Welding Alloys Corp. in 1940 at the invitation of government officials who were seeking an improved method of metal joining for military production.

Briefly, the new filler metals are capable of making weldments at substantially lower temperatures than conventional welding rods, thus alleviating the dangers of stress, warpage, brittleness, and serious change in the base metal. The process is based on scientifically planned utilization of the affinities of metals, and a phenomenon known as surface alloying. Even though low application heats are employed and the operation is speeded up and simplified, the resulting bonds are stronger than the base metals.

Applications of "Eutectic" Process

Some of the applications in which this process has been found adaptable in the plastics industry are interesting.

STRAIN BARS. Figure 1 shows seven strain bars which failed in service and were repaired by welding, with a minimum amount of machining. The breakage of strain bars is not an uncommon incident, since they break readily if the plastic is not warm enough. Since the bars have specially threaded sections, they are costly to replace. The total cost of repairing the seven bars was about half the cost of a single new bar, yet

the welded bars perform as effectively in service as new shafts. Many attempts have been made in the past to weld such shafts with conventional electrodes, and not only did the bars fail again adjacent to the weld, but warpage usually made the strain bars unusable.

Figure 2 shows (right) a broken strain bar, and (left) one that has been rejoined in an Ohio plastics plant. The procedure used for this repair consisted of mechanically bevelling the broken ends and aligning the segments on vee blocks. Then, EutecTrode* 680 AC-DC, size ⅛-inch was deposited with a standard arc welding machine to fill the bevel. EutecTrode 680 AC-DC is an electrode having an ultimate tensile strength of up to 120,000 psi., and high physical properties. It has non-cracking qualities even when applied to high alloy or high carbon steel. Because of the low heat input, distortion is not a problem and the deposit is readily machined to final dimensions. The illustration shows the lack of undercut, porosity, and spatter, and the fine appearance of weld.

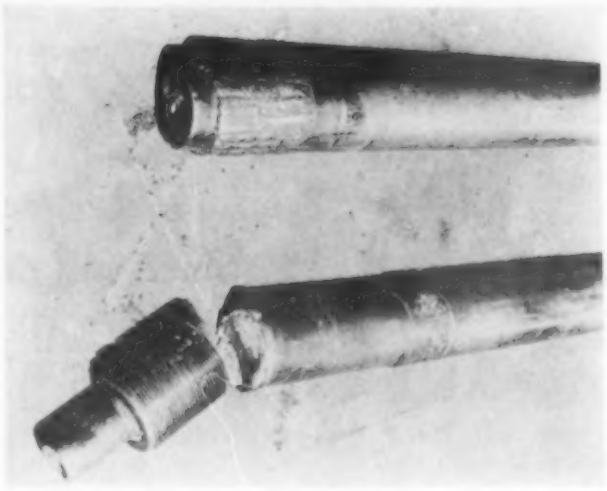

Fig. 2. Close-up showing (lower) broken strain bar, and (upper) after repair by welding.

PRESS PLATENS. Figure 3 shows an alloyed cast steel platen from a Reed-Prentice press during repair. Through extended service, the sleeves had been worn to unusable tolerances, and constant vibration had resulted in base metal fractures which would have destined the platen to the scrap heap had a more economical solution not been found. After repair of the platen to the point shown in the photograph, it needs only final machining before it can be placed back into full service where it will perform as well as new equipment for all practical purposes.

The procedure used for repair of the platen was not difficult. The cracks were gouged out with EutecChamferTrode* (DC), an electrode which removes unwanted metal. This unique metal-removing tool operates on any DC arc welding machine without oxygen, compressed air, or special holders. It removes metal approximately seven times as fast as a pneumatic chipping gun, and 12 times as fast as a grinding machine. After the cracks were bevelled, they were joined with EutecTrode 680 AC-DS at low heat input. The worn areas in the sleeves were overlaid, using the same electrode. Although no preheat was used, the deposit inside the sleeves was later machined readily with standard tools. A new platen, including freight and handling, would have cost more than a thousand dollars, yet the practical repair shown in the illustration cost less than 7% of this amount.

PUMP SHAFTS. EutecTrode 680 AC-DC has often been used in plastic plants to rebuild worn stainless steel pump shafts, since it is equal in corrosion resistance to stainless steel as well as having the other properties previously mentioned. A smooth overlay is deposited on the pump shaft, which then is machined and restored to service.

SAFETY GATES. Aluminum safety gates are often used, and eventually crack or break and must be repaired. EutecRod* 21, used together with Eutector* Flux 21X, is applied with a torch and results in high strength, permanent repairs without sagging, wrinkling, or collapsing of the base metal. Because this alloy is applied to aluminum well below that metal's melting point, and because of its affinity for all analyses of aluminum, it is readily applied by any mechanic, regardless of skill. The fracture is bevelled, and the alloy deposited by a technique resembling brazing.

PRESS CYLINDERS. Recently, a Pennsylvania plastics firm had a hydraulic press which had scores in the cast iron cylinder. These were filled in and permanently repaired with EutecRod 15, used together with Eutector Flux* 15, in a matter of minutes. This alloy bonds readily to cast iron at a temperature of less than 500° F., and was found to be soft enough to scrape, thus saving machining, yet tough enough to last permanently.

Figure 4 illustrates the salvage of an injection press cylinder head where improper assembly had caused the threads to be stripped. The threaded sleeve was cut off and a new threaded section, capable of withstanding tremendous pressures, was welded to it with SteelTectic*.

(*Continued on page 665*)

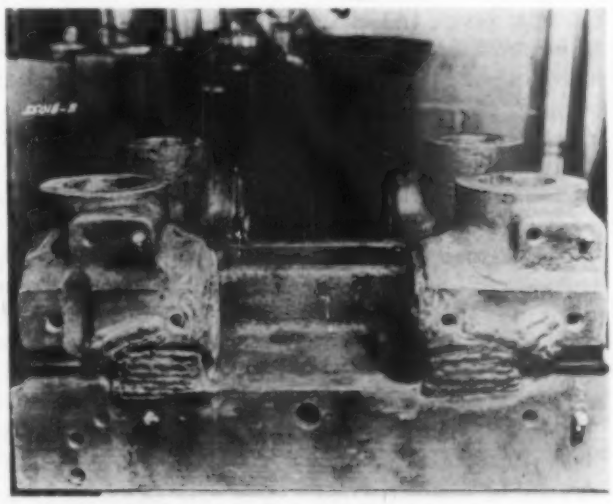

Fig 3. Cast alloy steel platen from a Reed-Prentice press during repair by welding. Repair is shown prior to final machining.

*Trademark of Eutectic Welding Alloys Corp.

JEROME L. BEEN, *Technical Director (left)*
and
MARTIN M. GROVER, *Chief Chemist (right)*
Rubber & Asbestos Corp.
Bloomfield, N.J.

Forrest's Photo Studio

Use of Adhesives with Reinforced Plastics

Recent developments in resin adhesives are described with case histories of their use in solving difficult bonding problems.

ADHESIVE bonding has become a widely accepted, important production tool. Recent advances in the field of synthetic resins and elastomers have provided the adhesive formulator with the raw materials to produce adhesives which are "structural" in their properties, and of extreme usefulness in solving reinforced plastics-to-metals bonding applications. While the adhesives available today may not solve all existing problems, they are far more useful and certainly more versatile than is suspected by the designers.

This discussion will provide data on these newer adhesives, and will then describe several difficult problems in the reinforced plastics bonding field and how they were solved with currently available adhesives. These problems are typical; some are quite new and very interesting, but most have wide application throughout the industry. It is hoped that more widespread application of the proven bonding tool which adhesives represent will be stimulated by an understanding of the properties of the many new and excellent adhesives which are available to the designer as production tools, and by the example of these described solutions.

The new synthetic resin and elastomer adhesives are chemically related to the new plastic materials, particularly those used in "reinforced" applications, which also are being adapted for structural (load bearing) applications. Adhesive bonding is the logical choice as a fastening method for the production of structures composed of reinforced or rigid plastics for any and all of the following reasons:

(1) Plastics are frequently used by themselves where exposed metals must be avoided, such as in applications where acid resistance is required. This obviously precluding the use of metal fasteners such as screws or rivets.

(2) Alternately, plastics may be used to cover or protect metals. Here, an unbroken plastic surface is essential.

(3) The plastic may not be rigid enough to accept piercing and the high stress concentration involved with a metal fastener.

(4) Many plastics, and particularly the cross-linked

or thermoset reinforced plastics, cannot be bonded to themselves or to other materials by a thermal welding or heat-sealing technique.

(5) The many excellent reasons for using adhesive bonding with any materials, as given in the literature (1 and 2)*, including:

(a) Ability of the adhesives to join dissimilar materials.
(b) Elimination in many cases of the need for high temperatures during joining.
(c) Ability to fasten materials to very thin metal structures.
(d) The sealing action, insulation, and vibration damping properties contributed by the adhesive.
(e) Uniform stress distribution over the bonded area.
(f) Smooth surface contour resulting from the elimination of projecting fasteners.
(g) Reduced production costs through lowered overall man-hours.
(h) In many cases, reduced weight and increased service life.

Adhesive Formulations

The general chemical relationship between adhesives and plastics not only contributes to good specific adhesion to plastics, but also assures that properly formulated adhesives closely match these plastics with regard to modulus, flexibility, toughness, resistance to thermal degradation, solvent and chemical resistance, and cohesive strength.

In combining reinforced plastics to metals, proper formulation requires that a more rigid adhesive be provided than for plastic-to-plastic bonding; i.e., one with a modulus, cohesive strength, and coefficient of thermal expansion between that of the plastic and the metal. In general, such adhesives exceed the strength of the plastic adherend in many respects.

Since most reinforced plastics are quite resistant to solvents and heat, heat-curing solvent-dispersed adhesives may be used; obviously, these could not be considered for bonding many thermoplastics. This group of adhesives consists of reactive or thermosetting resins such as phenolics, epoxies, urea-formaldehydes, alkyds, and combinations of these, together with compatible film-formers such as elastomers or vinyl-aldehyde condensation resins. The addition of isocyanates is frequently resorted to as a modifier to improve specific adhesion to various difficult-to-bond surfaces. These adhesives may be applied not only in solvent-dispersed form, but also in film form, either unsupported or supported on fabric, glass mat, etc.

One type of solvent-dispersed formulation includes a monomer (such as vinyl or acrylic) as the solvent; a dissolved polymer of the monomer as the film-former to raise viscosity and decrease shrinkage; and a catalyst, packaged separately and added just before use, to polymerize the monomer. Cross-linking monomers in small proportion, such as divinylbenzene and triallylcyanurate, improve the bond strength as well as the heat and solvent resistance of adhesives of this type. Reference (3) describes applications and formulations of monomer-polymer adhesives.

The following tensile shear bond strengths are typical:

Plexiglas-to-aluminum	900 psi.
Plexiglas-to-stainless steel	Over 1,200 psi
Aluminum-to-aluminum	4,200 psi.

A great many of the outstanding new formulations are based on epoxy resins. The use of "polymeric" hardeners, such as polyamides and polyamines, phenolics, isocyanates, alkyds, Thiokol-amine combinations, etc., and the "alloying" of the epoxy with compatible polymeric film-formers, such as polyvinyl acetate and certain elastomers, has led to the development of a broad spectrum of adhesive formulations with a wide range of available properties. In general, these properties are characterized by toughness, high cohesiveness, and specific adhesion to a great many materials, including most plastics. In addition, many of these adhesives are solvent-free.

By the selection of the proper hardener [and several chemical families of varying reactivity are available (monomeric, polymeric, or mixed)], room temperature, "low" temperature, or elevated temperature cure cycles may be utilized. Generally speaking, the phenolic-epoxy and the elastomer-phenolic-epoxy blends are characterized by outstanding high temperature resistance.

Reference (4) presented valuable data on adhesives available prior to 1952. Since, that date, there have been superior and interesting adhesives developed and marketed by many companies. Figure 1 provides plots of tensile shear strength versus temperature for several of these adhesives, as measured by tensile shear strength of 1 x ½-inch joints between acid-dichromate cleaned panels of 2024-T3 aluminum tested in accordance with MIL-A-5090B specification.

The following are the chemical types of the adhesives included in Figure 1:

Bondmaster M654	Elastomer-epoxy
M24B	Elastomer-phenolic-epoxy
M623**	Vinylaldehyde-phenolic
M611**	Vinyl epoxy
Shell 422J	Epoxy-phenolic
Bjorksten P227	Methylmethacrylate bas

It is of interest to note that Bondmaster M654 and Bjorksten P227 were cured at room temperature.

Reference (5) provides recent additional and very detailed data on strengths of adhesives over a wide temperature range. These data are typical of that obtainable with some of the newer and excellent adhesives recently developed. In using these to bond metals and plastics, good results will be obtained only if:

(1) Proper adhesives are selected for investigation, based on a comprehensive study of the physical strength properties which will be actually required of the assembly, and the physical, chemical, and specific adhesion characteristics of the adhesive (as indicated by data sheets or consultation with the adhesive manufacturer).

*Numbers in parentheses refer to bibliography at end of article.

**Bloomingdale FM47, Honeyco 371W, and Cycleweld 55-20 also are vinyl-phenolic based, and Shell Epon VIII is vinyl-epoxy based. This does not imply that identical results will be obtained with these adhesives as with the listed Bondmaster materials.

(2) The physical form and viscosity of the adhesive are such as to permit convenient and economical application characteristics. These adhesives may be powders, 100% solids pastes, solvent solutions, or films, and each type requires different application equipment. Multi-component, short pot-life materials offer a special and difficult problem.

(3) Curing cycle of the adhesive is matched to the operating schedule of the assembly plant.

(4) Both metal and plastic surfaces are cleaned by the best available techniques.

(5) Design of the joint takes advantage of the best properties of the adhesive and the materials bonded, and to protect against their worst properties. Thus, joint design must be of proper configuration and adequate area.

(6) Adequate bonding jigs and fixtures are provided.

Under the auspices of the Forest Products Laboratory and Wright Air Development Center, a great deal of constructive work has been done on surface preparation of metals and plastics to receive adhesives (6). Specific chemical treatments exist for each metal commonly encountered so as to provide nearly perfect wetting by the organic adhesives. With plastics, surface mold release agent must be removed. Sanding of plastic surfaces removes mold gloss and usually is advantageous. However, where the specific adhesive strength to the plastic is high, sanding occasionally reduces bond strength by providing nuclei for cohesive failure of the plastic.

Applications to Problems

The following are six specific problems solved satisfactorily through the use of modern, currently available adhesives:

Structural Sandwich

This problem concerned all-plastic "sandwich" construction for structural service (short-time exposure at 300-500° F.). The core was 0.625-inch thick, (CTL 3/16-112-6.5) (CTL 91LD phenolic resin on glass cloth) made by Hexcel Corp. The skins were 0.029-inch thick CTL 91LD-base glass laminate with a minimum compressive strength of 23,000 psi. at 500° F. The adhesive used was Bondmaster M697 (commercial version of North American Aviation's CHT), a liquid elastomer-phenolic-based adhesive of 90% solids at about 25,000 cps. viscosity.

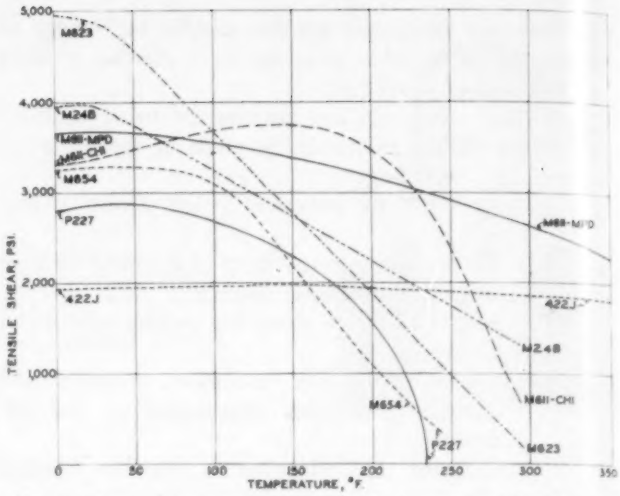

Fig. 1. Effect of temperature on tensile shear strengths of seven adhesives.

The skins were sanded, primed with phenolic, force-dried, and the adhesive was sprayed on. A layer of adhesive-impregnated glass cloth was set in place, and another coat of adhesive applied and force dried. Total adhesive was 0.45 gms/sq. in. Cores were dipped in phenolic (CTL-91LD) to a depth of ⅛-inch and air-dried. The assembly was cured at 50 psi. pressure for one hour at 180° F., followed by one hour at 275° F.

Physical properties of the resulting sandwich (7) are presented in Table 1.

Foamed-In-Place Sandwich

This problem involved the preparation and measurement of "design allowables," for foamed-in-place plastic sandwhich construction at room temperature and 230° F. The sandwhich consisted of ½- and one-inch thick cores poured in place with Lockfoam BH-610***, a 10-pounds per cubic foot (expanded) polyester-diisocyanate based plastic foam, between 0.040-inch thick 2024-T3 aluminum skins. It was desired to measure edgewise compression, transverse shear stress in core, and flexure

***Product of Lockheed Aircraft Corp.

Table 1. Physical Properties of Plastic Sandwich

Property	Bondmaster M697		Designer's Target	
	Room Temp.	500° F. (½-Hr. Soak)	Room Temp.	500° F. (½-Hr. Soak)
Tensile shear (aluminum-to-aluminum), psi.	1,920	1,710	1,000	1,000
Bend strength (aluminum-to-aluminum), lbs./in.	95	87	65	65
Ultimate load of plastic sandwich, lbs.:				
Skin critical	1,110	720	—	567
Core critical	1,840	930	—	630
Tensile shear (skin-skin) at ambient temperature, psi.	Average 1,100*		—	—

* Several specimens failed by delamination of the skin laminate. Best results obtained by sanding of laminate; most uniform results obtained by priming skin with diluted adhesive (5% solids).

Table 2. Average Test Results on Lockfoam Sandwich

Test Condition	Edgewise Compression Face Stress, Psi. One-In. Thick Panel	Edgewise Compression Face Stress, Psi. ½-In. Thick Panel	Transverse Shear Stress in Core, One-In. Thick Panel, Psi.	Bending Test Flexure Stress, ½-In. Thick Panel, Psi.
Room temp.	33,300	26,000	65.6	11,505
At 230° F.	30,300	24,500	40.3	8,707
Aged 100 hours @ 230° F.:				
Tested at room temp.	31,500	26,100	67.6	11,972
Tested at 230° F.	28,900	22,100	36.0	8,070
Total no. of tests included in above average	19	38	12	26

stress by the methods of Forest Products Laboratory Report No. 1556 (revised February 1950).

Preliminary tests indicated that an adhesive was required between the foamed plastic and the skin, otherwise interfacial failures occurred. After testing eight structural adhesives, Bondmaster M24B was selected as that which most consistently provided cohesive rather than adhesive failures. Bondmaster M24B is a liquid, solvent-dispersed elastomer-phenolic-epoxy co-curing formulation qualified under Military Specification MIL-A-5090B.

The faces were vapor degreased, acid-dichromate cleaned, washed, dried, and given a brush-coat of M24B on one side. The reverse side was coated with DC-7 Silicone parting agent. The coated skins were placed in the mold and precured for one hour at 150° F. The Lockfoam ingredients were weighed and mixed, then poured into the mold which had been cooled to 120° F., After 10 minutes at 120° F., the temperature was raised to 290° F. and the foam and adhesive cured for four hours. Test results are presented in Table 2.

Attachments for Sandwiches

This problem concerned the fastening of metal attachments to sandwich panels composed of polyester-fiberglass skins and foamed polystyrene cores, and fabrication of the sandwich.

Figure 2 shows the design of a channel pad which features projecting steel bolts bonded into the sandwich. Total withdrawl load for a 10-square inch glue line is 685 pounds, resulting in core failure. Figure 3 shows various panel end reinforcements bonded to panel, and illustrated as box joints. These end attachments have been made of polyester-fiberglas and of aluminum. The box was exposed for three months at 130° F. and 100% relative humidity, without perceptible effect on panels or bonds.

Figure 4 shows use of angle attachments to provide intermediate connections to the panels. Structural steel or plastic angles may be shop cemented to the panels. Field assembly involves the use of self-tapping screws for the metal angles, and bonding of the plastic angles. Metal angles also may be field cemented where time and working conditions permit.

The adhesive especially developed for bonding the core and skin to itself, to metals for edge attachments, and to inserts on hardware is Bondmaster M650. This is a high-solids, elastomer-modified, room-temperature curing epoxy. The adhesive contains a solvent which will not attack the foam. The elastomer modification provides a high degree of "building tack", and fair peel strength (in the order of 12 pounds per inch).

In the sandwich assembly, fluid 100% solids epoxy adhesives, such as Bondmaster M648, are used to bond

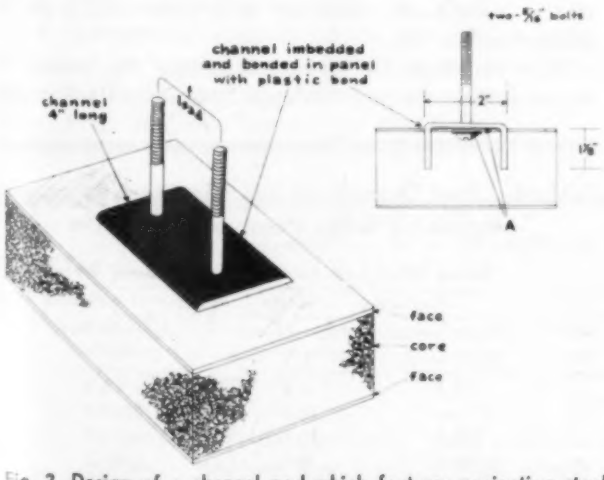

Fig. 2. Design of a channel pad which features projecting steel bolts bonded into the sandwich. Faces are 0.030- or 0.060-inch fiberglass cloth polyester laminates; core is two-pound (or higher) density self-extinguishing foamed polystyrene.

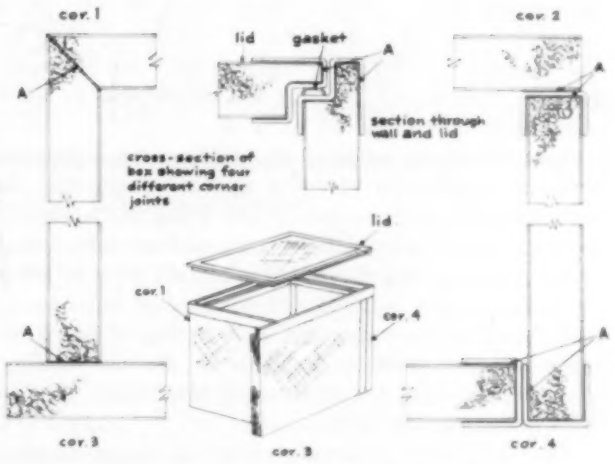

Fig. 3. Panel and reinforcements bonded to the panel and illustrated as box joints.

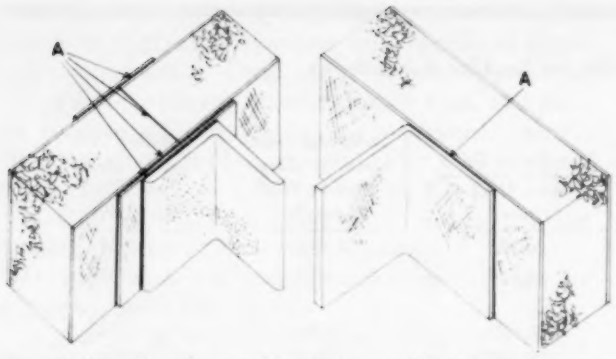

Fig. 4. Use of angle attachments to provide intermediate connections to the panels: (left) panel joint fastening to structure; and (right) attachment with plastic angle.

the skins to the core (see Figure 6). Although many inexpensive elastomer-based solution adhesives will provide bond strengths greater than that of the core, excessive attack by their solvents on the thin walls of the polystyrene foam renders them unsuitable. Where self-extinguishing properties are required of the laminate, a treated "non-flammable" polystyrene core is used with Bondmaster M664, a special non-flammable filled epoxy paste adhesive.

Laminating Kel-F

Kel-F polychlorotrifluoroethylene resin has remarkable heat and chemical resistance, mechanical strength, and electrical properties. However, its saturated nonpolar structure has defied the best efforts of the adhesive chemist, insofar as "specific adhesion" is concerned. This also applies to Teflon tetrafluoropolyethylene and, to a lesser extent, to rigid polyethylene.

The solution to this problem is to reinforce the Kel-F and bond the protruding reinforcing fabric to the other adherend with "conventional" adhesives. By means of calendering and pressing techniques at proper temperatures and pressures, a base laminate is produced consisting of a sheet of Kel-F plastic having an effective thickness of 10-12 mils, with partially-embedded glass cloth reinforcing the plastic and providing an adherable surface. The total thickness of the laminate is 23-26 mils. The glass is either Volan A, #114, #136,, or Garan treated, and is generally of Type 181 glass cloth in a moderately tight, seven-harness satin weave. Heat-cleaned #112 glass cloth also is satisfactory, but has lower strength. Starch (Greige) finishes are not satisfactory because they blacken and decompose at Kel-F finishing temperatures (45°-550° F.).

The procedure followed in bonding the reinforced laminate consists of cleaning and/or roughening the other adherend surface; curing and fitting the laminates; applying adhesive to both laminate and supporting surfaces; applying and maintaining contact presure while the adhesive sets; hot or cold forming of laminate to conform to manholes, outlets, etc.; sealing of seams between adjacent sheets of laminate by thermal welding, using fluxing tape, etc; and testing electrically for pinholes or incomplete seams.

After extensive screening, fluid elastomer-modified epoxy formulations were selected for all-purpose work. Bondmaster M648 with Hardener CH-16 provides excellent adhesion to the metals, through penetration and anchorage of the glass cloth backing, and convenient and practical pot life (45 minutes). At room temperature, enough strength is developed in six hours to permit removal and jigs and clamps, and full bond strength is attained in 72 hours. Although this adhesive is not as thermally stable as the Kel-F plastic facing, tests have shown that it retains its high initial bond strength after several months at 300° F.

Table 3. Peel Strength of Kel-F to Steel Bonds with Bondmaster M648/CH-16 (Epoxy) Adhesive

Test No.	Stress When Laminate Broke, Psi. Room Temp. Cure Only	After 7 Days at −114° F.	After 30 Days at 300° F.
1	17.8	14.0	9.4
2	12.2	17.0	14.5
3	13.2	12.3	9.2
4	14.6	12.0	8.5
5	12.3	12.7	11.1
6	9.0	17.2	5.2

Where service temperatures will not exceed 150° F., certain neoprene-phenolic adhesives, including Bondmaster G423 and Carboline F-1, show promise. These formulations have the advantage of "instantaneous grab", eliminating the need for jigs and fixtures. Bondmaster M244, an epoxy adhesive with good "grab" and superior heat resistance also shows promise.

Tables 3 and 4 provide data on strengths of bonds between Garlock green Kel-F laminate and grit-blasted low carbon steel. Measurements were made on an Instron Tensile Tester (see Figure 5) with a cross-head speed of 0.2-inch per minute, and a chart speed of two inches per minute. The laminate was cemented on a one-inch wide fixture for a distance of five inches. The machine was set for peel, with the supporting jaws 6¼ inches apart at the start.

Applications of the Kel-F plastic laminate include lining of tanks, reactors, pails, pipes, fume ducts, etc; surfacing of laboratory bench tops, resin casting forms, foam rubber molds, etc; and fabricating of reinforced-plastic honeycomb sandwich structures with a Kel-F plastic surface (8).

This technique of fabric-reinforcing the plastic to secure adhesion is probably applicable also to Teflon and

Table 4. Peel Strength of Kel-F to Steel Bonds with Bondmaster G423 (Neoprene) Adhesive

Test No.	Stress When Laminate or Adhesive Bond Broke, Psi. Rupture of Laminate: Room Temp. Cure Only	Rupture of Laminate: After 7 Days at −114° F.	Rupture of Adhesive Bond: After 30 Days at 150° F.
1	12.1	11.4	4.4-5.8
2	—	10.0	7.3-8.4
3	8.8	10.4	6.2-7.2
4	9.6	8.0	5.4-7.6
5	7.9	—	7.2-8.8
6	8.3	—	6.6-7.0

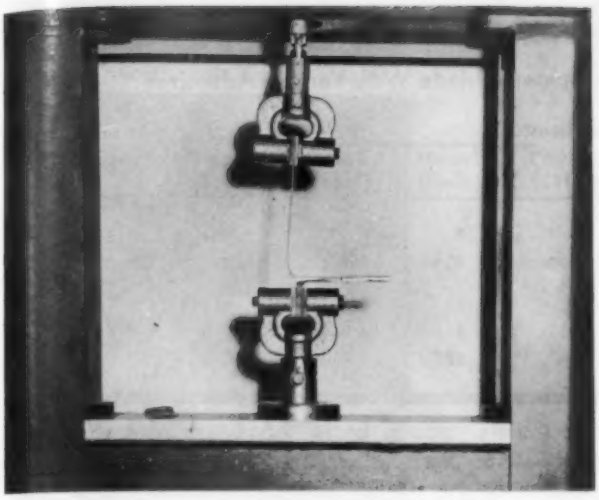

Fig. 5. Measuring the strength of bond between Garlock green Kel-F laminate and grit-blasted low carbon steel on an Instron Tensile Tester.

polyethylene. Other methods of bonding to these refractive plastics in rigid foam include the use of "sticky" pressure-sensitive adhesives, some of which (based on siliconic resins) are quite heat-resistant although weak; mechanical or chemical surface-abrasion to produce "cementable" surfaces, a fairly successful operation and hot-melt adhesives (9) which are claimed to bond polyethylene at values equal to its cohesive strength.

Laminated Boards

This problem involved the bonding of decorative and structural laminated boards having metal components. Two constructions have been developed for different applications. These are variations of the standard decorative laminate board, which consists of "cheap" paper-based phenolic filler sheets, a sheet printed with the design, and melamine- or urea-saturated paper face sheet. The constructions are:

(1) Decorative sheets of the high strength and low total inflammable matter content, for use as panels and bulkheads of ships, busses, trains, hotels, etc. Here, an adhesive-coated sheet metal replaces the conventional phenolic filler sheets. This sheet metal is bonded to the design paper and plastic-saturated face sheet.

(2) Inexpensive composite boards, where the phenolic filler sheets are bonded to an adhesive-coated metal face sheet. The metal supplies whatever decorative features are required, and adds to structural rigidity.

Vinyl aldehyde-phenolic adhesives, such as Bondmaster M693, provide good bonds; and vinyl aldehyde-phenolic-epoxy adhesives, such as Bondmaster ZZ129A, provide bonds which are stronger in shear and peel than the paper-phenolic boards used in conventional decorative laminates. The adhesive is sprayed onto the metal and force-dried. Adhesive-coated metal may be stacked or rolled and stored for many weeks at 80° F. or below prior to laminating. The standard laminating presses are suitable, and the cure cycle of the phenolic or melamine resin impregnant is adequate for the adhesive (typically, 20 minutes at 310° F. under 1,200 psi. pressure). Table 5 provides data for both adhesives, M693 and ZZ129A.

(3) Review of adhesive assembly of copper-clad laminates for printed circuit applications.

Printed Circuit Laminates

This problem concerned the production of a composite structure consisting of an electrically-resistant reinforced plastic laminate baseboard to which is firmly attached a thin conductive metal foil to be processed to the desired circuit design. The adhesive must provide strength to resist separation by mechanical handling of components soldered to the foil, usually measured by a peel-back method (NEMA Specification minimum, four pounds per inch); and resistance to thermal shock of soldering, measured by observation of bonded specimens immersed for 10 seconds in molten solder at desired temperature. The assembly must retain its strength through out the working life of the electronic equipment at its working temperature. The adhesive must be as effective an electrical insulator as the plastic baseboard, and must not be affected by resists, etchants, strippers, or plating baths used in the circuit fabrication.

By far the largest volume of printed circuit are produced by etching the circuit pattern through copper foil bonded overall onto the surface of the plastic baseboard. The foil is usually 0.0014 or 0.0028-inch thick, and may be of either electrolytic or rolled origin. It must be cleaned chemically to remove oils, rust-preventives, loosely-adhering oxides and sulfides, and dirt, and may be chemically prepared by etching or controlled oxidation to improve the bond. It must then be coated or bonded promptly with adhesive, since the cleaned surface oxidizes rapidly.

Adhesive practice (10) varies between laminators. Many prefer to purchase precleaned, adhesive-coated foil, which is marketed as Plymaster. Three grades are produced, Types N, G and F, which use adhesives based

Table 5. Bond Strengths of Decorative Laminate Adhesives

Materials Bonded*	Adhesive M693 (Modified Phenolic)	Adhesive ZZ129A (Modified Epoxy)
Aluminum-aluminum	2,100 psi.	3,400 psi.
Phenolic C-aluminum	1,040 psi.**	1,090 psi.**
Phenolic XXP-XXP	575 psi.**	580 psi.**
Cleavage, C phenolic-aluminum	50% cohesive failure in laminate.	100% cohesive failure in laminate.
Cleavage, steel-hard fibre	90% cohesive failure in laminate.	100% cohesive failure in laminate.

* Cured 10 minutes at 300° F. and 250 psi.
** Failure within laminate

Table 6. Bond Properties of Printed Circuit Laminates Made With Various Adhesives

	Bondmaster	Plymaster			
	M693 (BJ 16320)	Type N (Vinyl)	Type G (Phenolic)	Type F (Epoxy)	Ebonol C plus Goodrich A458B
Phenolic baseboard:					
Peel strength, lbs./in., after 10 secs. solder dip	6	8	11	10	14
Temperature, °F.	390	430	480	490	—
Epoxy baseboard:					
Peel strength, lbs./in., after 10 secs. solder dip	—	9	—	9	11
Temperature, °F.	—	485	—	510	—

on vinyl, phenolic, and epoxy resins, respectively. Alternatively, the laminators themselves may apply adhesives to the treated or cleaned copper. Vinyl butyral-phenolic adhesives, such as Bondmaster M693, were quite popular at one time for this application, but have been largely supplanted by modified epoxies to meet current more stringent heat-resistance tests. Adhesives may be used either in film form (such as Permacel Tape 1824, a vinyl-phenolic), or as an epoxy-saturated glass layer which is inserted between the cleaned copper and the baseboard.

The volume baseboards are XXX-P paper-based phenolic and both paper- and glass-reinforced epoxy laminates, but practically all other insulating boards are used to some extent. The assembly may be made by bonding the copper to either a precured board, or by bonding with the green resin-impregnated layups in the laminating press, thus forming the laminate and copper-cladding in one pressing. Typical values obtained with some assemblies, using 0.0028-inch thick electrolytic copper with XXX-P phenolic and glass-based epoxy baseboards appear in Table 6.

Intensive research and development efforts are being devoted to the "plated" methods of producing printed circuits. Tentative procedures consist of adhesive-coating a pre-cured, pre-punched base laminate; applying an overall tie-coat of silver or copper by vacuum deposition, chemical reduction, flame spray, etc; imprinting the negative circuit pattern with a plating resist ink; electrodepositing the circuit in copper to the desired thickness; stripping off the resist and excess tie-coat metal film; and baking to cure the adhesive, if required.

Pilot production units are in operation on processes of this type, using an elastomer-phenolic and an elastomer phenolic epoxy adhesive (Bondmaster M389). Results obtained so far do not match those of the etched press-formed copper clad laminate, and typical peel strengths of only four pounds per inch have been achieved. However, this process has great future promise, since it is adaptable to fully-automated production line techniques. Further economies result from the use of only that amount of copper required for the final circuit pattern, and from the use of unclad baseboards which are available competitively and in volume from a great number of laminators. The limited supply of electrolytic copper foil and the limited number of facilities available for chemically cleaning rolled foil have prevented the plastic laminators and printed circuit etchers from supplying the full potential of the market.

In the six "case histories" briefly outlined above, the intention, of course, is merely to indicate that by the selection of the proper adhesive and the use of good technique, a high percentage of today's plastic-to-metal bonding problems may be solved with the effective, available adhesives which have been recently developed.

Acknowledgments

We wish to express our grateful appreciation for the cooperation of the following individuals and companies who have contributed to the contents of this paper: Dr. Richard Smith, M. W. Kellogg Co.; George Meier and Lester C. Preston, Haskelite Mfg. Co.; David Reid, Republic Aviation Corp.; Max Nadler, Irving Katz, and Raymond Cutler, North American Aviation, Inc.; and Bernard Gould, of our company.

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Guest Editorial

Royce Studios

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Are You Financing Your Competitor?

In spite of the rosy picture which has been continuously painted by the trade journals of technological advances leading to lower and lower molding costs, there exist in our industry all the ingredients for a first-class revolt of the molders against the big chemical companies. These grievances have never been printed or publicized by our trade journals, nor even allowed to be discussed openly and freely in organized meetings. I realize that the powder giants are the main supports of most channels of communications and the S.P.I., and that this is why most editors and moderators feel that these legitimate wrongs must be either ignored or completely covered up. The time has come for someone along the line to call a spade a spade. The honest, responsible molders are being squeezed to death between the federal government's wicked tax program and the iniquitous, unfair trading policies of some of the big chemical companies.

I have not the space here to go into the many ramifications of the federal government's tax structure, but suffice to say that had Stalin himself written the tax laws, he could not have done a better job to stifle small business.

Added to this, to which we all feel that there will be no recourse ever, is the fact that the chemical and powder companies—who purport to be the molders' allies and friends—are working just as effectively against us. The list is long: tremendous credits extended to some; uniform price rises by all the big companies at the same unpredictable time; and the skillful, behind-the-scenes politicking that sets molder against molder with the ultimate goal of selling more material irrespective of whether the molder takes a loss or not. And it all works; the average molder's return on his investment is only 2.9%, while the chemical companies *average* 18%!

The giant companies say they treat all their customers with fairness. Is it fair to extend credits of up to a quarter of a million dollars, thereby supplying one customer with free material? Is it fair to allow hundreds of dollars credit to customers who then declare bankruptcy, liquidate, buy back their best machinery, and set themselves up in business again? Is it fair to sell, on credit naturally, three-quarter million dollars' worth of material to a firm which then advertised plastic sheet for sale in odd lots (25,000 pounds or more) at 34¢ per pound? The molder who pays his bills paid 32¢ per pound for the powder. And, is the high-handed, customer-be-damned, why-bother-with-public-relations manner in which the companies swoop down with a price raise exactly fair? There isn't a responsible, self-respecting molder who does not disagree, and there isn't a responsible molder who doesn't have a grievance of his own. We who pay our bills on time; we who try to operate an honest, open business are being penalized by our own integrity. We cannot be competitive if we all do not operate under the same rules.

When we were offered the sheet material at 34¢

(Continued on next page)

per pound, we shelved vacuum forming and perfected a radical modification of the old German "Schlag Pressen" technique. Time has proved our decision sound as we are able to approach the material manufacturer's dream that material cost should represent 80% of the molder's selling price. However, no representative of the big companies will ever see our presses; I don't want this information passed on free to credit-riding competitors!

Unfortunately, the individual molder cannot compensate in his own plant for all the iniquities. The big companies must clean up their own messes. They made the credit fiasco; they made non-competitive we poor fools who honor our bills; they may be cutting off their noses to spite their faces; and they could remedy the situation. I suggest they study the ready-mixed concrete industry. This industry was faced with a collection problem that was solved by allowing a 10% discount to the contractor who pays his bills in 15 days. The man who didn't pay was not competitive, and huge credits did not roll up.

As for price raises, U. S. Steel feels it necessary to educate the public about the necessity of a rise in steel prices; then we do not complain so much when General Motors raises the price of cars. Dow, Monsanto, DuPont, and Bakelite all have large and elaborate advertising facilities; why can't they educate the public about plastic? I don't mean the finished 19¢ product; I mean the expensive powder that went into that plastic product the buyer thinks costs too much.

I urge that all molders who are interested in returning a modicum of integrity to our business join me in insisting on a 10% discount on all material, even though it may be necessary to raise the price. This discount will put the honest molder who pays his bills back in the market, and it will soon eliminate the sharp characters who are looking for the tax break of bankruptcy. I realize that the powder giants dominate the most vital part of our industry. Let us learn a lesson from them; in the way they act together, almost as one person, in many of their policies. We molders should act together to keep this an industry in which we all have the same opportunity for profit and gain. If we molders expand our markets, the markets of our suppliers are likewise expanded. I suggest we join together to clean up the unfair practices that have been forced upon us. The big chemical companies have conclusively proved that in union there is strength, and only through strength will the molders' rights be respected.

—THE END

(PLASTICS TECHNOLOGY *does not censor in any way the opinions expressed by authors of our Guest Editorials.)*

High-Fidelity Speaker

Uses Mylar Electrode

Mylar polyester film is used in a new type of electrostatic, high-frequency speaker, with a new high in efficiency and a lower degree of distortion. Half-mil thick Mylar film metalized with aluminum is used as the vibrating electrode in Philco Corp.'s new electrostatic, high-frequency speaker. A product of E. I. du Pont de Nemours & Co., Inc., the film is fitted over a perforated aluminum cylinder which serves as the stationary electrode. The speaker reproduces high fidelity sound in the 7,000-20,000 cycle range, and is both light in weight and attractive.

Old-style, bulky speakers, with the exception of the most expensive varieties, distorted sound at frequencies above 10,000. Sound waves were initiated in the voice coil at the apex of a paper cone, and were adversely affected by the cone's own characteristics. In addition to having high dielectric strength in the thinnest gages, Mylar displays a tensile strength of 23,500 psi.

—THE END

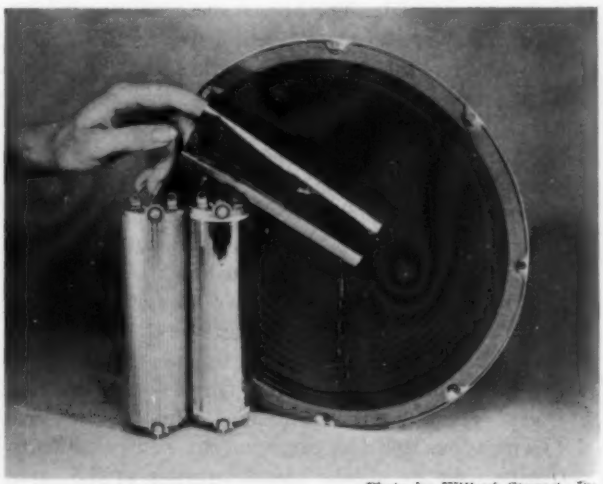

Photo by Willard Stewart, Inc.

Metallized Mylar film, perforated aluminum cone, and finished cylindrical speaker. The old-style, paper-cone speaker is shown in the background.

Photos by Pach Bros.

B. E. Godard

P. A. Thomas

J. L. Welch, Jr.

Epoxy Resins in Reinforced Plastics

Current developments in resins and curing systems, the mechanical and electrical properties of epoxy laminates, and their applications and future outlook.

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and
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CERTAIN essential design characteristics necessary for soundly engineered reinforced plastic structures are considered to be as follows:

(1) High mechanical strengths, both static and dynamic, coupled with a favorable strength-to-weight ratio.
(2) Good electrical properties.
(3) Resistance to chemicals and weathering.
(4) Versatility in fabrication.

These characteristics are available today in a relative newcomer to the thermo-setting resin family, the epoxy resins. Versatile epoxy materials lend themselves to fabrication by commonly employed laminating techniques, using both wet and dry systems. Pre-loaded reinforcing materials have been processed at pressures ranging from 10-1,500 psi. Reinforced epoxy parts have been made from liquid resins, using vacuum impregnation, matched metal molding, and hand lay-up methods. Experience has demonstrated the processing flexibility of the epoxy resins.

There are excellent reasons why the epoxies are establishing themselves in the field of reinforced plastics. Table 1 gives typical average properties of epoxy, polyester, and phenolic glass-cloth laminates. It can be seen that the epoxy laminate is superior to the phenolic in electrical properties; is superior to the polyester in mechanical properties; and surpasses both in water resistance.

In addition to advantages in mechanical and electrical properties and chemical resistance, the following outstanding properties of the epoxy resins have been noted:

(1) The highly desirable surface activity of epoxies in the liquid state allows wetting of and adhesion to a wide variety of reinforcing materials, including glass in its various forms, synthetic fibers, mineral fibers, and vegetable fibers.

Table 1. Comparative Glass-Cloth Laminate Properties*

	Modified Epoxy (ELSA-3001)	Polyester	Phenolic
Flexural strength, psi.	80,000-85,000	60,000-65,000	75,000-80,000
Modulus, psi. x 10^6	3.8-4.5	3.0-3.3	4.0-4.3
Tensile strength, psi.	55,000-60,000	43,000-47,000	50,000-55,000
Compressive strength, psi.	50,000-55,000	35,000-40,000	48,000-52,000
Power factor @ one megacycle	0.010-0.015	0.010-0.011	0.023-0.025
Arc resistance, seconds	150-180	155-180	20-40
Water absorption (24 hrs), % weight gain	0.02-0.07	0.2-0.3	0.3-0.6

*⅛-inch laminate, 32% resin content, 181 weave glass fabric.

(2) Low volume shrinkage because the highly associated nature of the liquid resin holds strain to minimum during cure.
(3) Resistance to weathering.
(4) Exceptional resistance to heat; i.e., they retain a high percentage of ultimate strengths measured at room temperature after exposure to elevated temperatures.

These advantages are common to most epoxy laminated systems. Naturally, optimum properties are obtained only when optimum cure is effected and proper fabrication procedures are followed. In addition, specific epoxy systems are designed to meet specific application requirements. This discussion will attempt to indicate the handling and curing processes which should be observed with typical epoxy systems. It also will attempt to draw some general conclusions, pointing out the future potential of these resins.

Laminating Resins

Initial moderate cure of epoxy laminates, whether a press cure or a hardener-initiated room temperature cure, yields structurally sound parts with the expected epoxy properties at moderate service conditions. It must be emphasized, however, that the superior properties, particularly chemical resistance and electrical and mechanical strengths measured at elevated temperatures, are dependent upon optimum cure.

Epoxide polymerization reactions, unlike those of polyesters, are step-by-step processes and require more stringent conditions for "full" cure. Full cure, with its attendant bonus properties, is approached by postcuring at elevated temperatures.

For hand lay-up and matched metal molding operations, liquid resins and hot melt types are recommended.

ERL-2774, ERL-3794, and ERL-2795 are liquid epoxy resins representing a range of viscosities and reactivities. ERL-2795 is a low-viscosity resin allowing easy incorporation of fillers and/or extenders such as calcium carbonate, aluminum silicate, and China clay. These fillers reduce the cost, lower exotherm temperatures, and prolong the working life of the resin/hardener mixture.

ERL-2774 and ERL-3794 have viscosities in the 7,000-20,000 cps. range, with ERL-3794 being the more reactive of the two.

The hardeners which may be used with these liquid resins vary in viscosity and curing speed. Some typical liquid hardeners are Bakelite epoxy ERL-2793, a fast, high viscosity hardener; ZZL-0812, a moderately fast, low viscosity hardener and ZZL-0803, a relatively slow, medium viscosity hardener. Typical of aromatic amine type hardeners is ZZLA-0800, a high heat-distortion hardener. The proper resin/hardener choice is predicated largely by the handling and end-use requirements. The use of flexible hardeners, such as General Mills' Versimide 115 and Thiokol polysulfide liquid polymers, is also possible with any Bakelite liquid epoxy resins.

Epoxy laminating systems derived from liquid resins, solid resins, and semi-solid resins are applicable to solvent or hot melt pre-impregnation of reinforcements, yielding dry, dust-free, easily handled, ready-to-mold stock.

ERLA-3001 is a very viscous modified epoxy resin which may be solvated for use in laminating. ELSA-3001, a 70% solids solution of ERLA-3001 in toluene, is available and eliminates the necessity for customer solvation of ERLA-3001. Most laminating plants are equipped to pump thin liquids, and ELSA-3001 fits very readily into their existing facilities.

EKRA-2002 and EKRD-2003 are brittle, grindable resins which are normally put into solution before use. In the laboratory, this is accomplished by coarse grinding the resin, putting it in a container with solvent, and placing the mix on rolls. Among the solvents for epoxy resins are acetone, ethyl acetate, methyl ethyl ketone, and toluene-isopropanol. ELSA-3001 may be cut with alcohol for treating solids.

Wet Lay-Up Laminates

For prototypes, for short runs where tooling is expensive, and for introductory work in reinforced plastics, the wet lay-up technique is still of importance. A series of room-temperature cured wet lay-up laminates of standard epoxy resins and liquid hardeners was made. Laminate properties were obtained on both postcured and non-postcured pieces. Postcuring the test panels gave a significant increase in the flexural strength measured at 160° F., but only slight to no increase in room temperature properties.

The 12-ply laminates made with Volan A finished 181 glass fabric were allowed to cure at room temperature without pressure. All panels were prepared by wetting one ply of the reinforcement at a time and putting it in place. Hand troweling and rolling were used to distribute the resin and completely wet the glass reinforcement.

Table 2. Properties of Wet lay-up Laminates of ERL-3794 Resin on 181 Glass Cloth with Volan A Finish

Hardener, equivalent weight parts ZZL-0803 and ZZL-0812	100/0	80/20	60/40	40/60	20/80	0/100
Non-Postcured*:						
Flexural strength, psi.	61,200	69,900	68,000	68,800	64,700	61,000
At 160° F.	4,870	6,400	6,300	7,800	9,600	13,200
After 2-hr. water boil	41,000	46,100	44,600	51,100	53,900	55,000
Flexural modulus, psi. x 10^6	2.72	2.94	3.30	3.04	2.79	2.74
At 160° F.	0.27	0.43	0.47	0.51	0.57	0.78
After 2-hr. water boil	2.50	2.96	2.68	2.82	2.85	2.79
Tensile strength, psi.	40,600	44,500	40,700	44,800	47,700	47,300
Modulus, psi. x 10^6	2.23	2.60	2.49	2.53	2.46	2.31
Edgewise compressive strength, psi.	37,900	38,000	42,000	31,800	27,400	32,800
Modulus, psi. x 10^6	2.53	2.75	2.95	2.92	3.00	2.92
Postcured:**						
Flexural strength, psi.	76,000	68,100	69,200	73,700	68,800	65,600
At 160° F.	19,600	32,400	48,800	55,700	52,400	52,100
After 2-hr. water boil	61,100	51,600	55,900	64,500	53,600	57,500
Flexural modulus, psi. x 10^6	3.05	3.21	2.92	3.36	3.09	3.12
At 160° F.	1.12	1.56	2.26	2.67	2.27	2.75
After 2-hr. water boil	2.76	2.63	2.54	2.99	2.52	3.00
Tensile strength, psi.	45,100	48,300	46,400	45,200	46,600	44,700
Modulus, psi. x 10^6	2.45	2.66	2.62	2.57	2.33	2.53
Edgewise compressive strength, psi.	45,600	46,700	46,900	46,500	47,500	46,500
Modulus, psi. x 10^6	2.78	3.12	3.14	3.02	2.70	3.07
Izod impact strength, ft.lbs./in. of notch	10.1	11.2	10.2	11.4	10.5	11.5

* Room temperature cure, no pressure.
** Room temperature gel, no pressure; post-cured 8 hrs. at 160° F.

Table 2 gives the properties of both non-postcured and postcured laminates of ERL-3794 resin hardened with ZZL-0803/ZZL-0812 mixtures. The postcured laminates were given eight hours at 160° C. (320° F.). Compared with the non-postcured laminates, the postcured panels gave about the same tensile strength, and a slightly increased compressive strength, a slightly higher flexural strength at room temperature and after a two-hour water boil.

There was a large increase in the 160° F. flexural strength because of the postcure. There also was a gain in this elevated temperature strength by replacing 40% of the ZZL-0803 with more reactive ZZL-0812. Replacement of a greater quantity of ZZL-0803 resulted in only slight further gains in strength.

In general, the change in a room-temperature property over the full hardener range for a postcured or non-postcured laminate was about 10,500 psi. or less. Pot life, which can be extended by the incorporation of greater amounts of ZZL-0803, could be a more important consideration in specific cases than the strength level.

Table 3 gives comparative properties of non-postcured and postcured laminates of ERL-2795 resin with ERL-2793 hardener. As in the previously discussed panels, the postcure gave only a slight improvement in room-temperature properties but a great improvement in 160° F. flexural strength. A comparison of this system with the ERL-3794 resin and mixed hardeners (see Table 2) indicates that the ERL-2795/ERL-2793 strengths fall in the lower part of the ERL-3794 laminate strength range.

Table 4 gives results of tests on ERL-3794/ZZLA-0800 laminates. As can be seen from the non-postcured flexural values, this system does not reach full cure without the application of external heat. The two-hour water boil flexural strength is higher than the others because of the added cure in the boiling water. Flexural properties of the postcured panel were good, and there was little loss in room-temperature flexural strength after water boil or at 160° F. As expected, the per cent retention of flexural strength at elevated temperature of this aromatic amine-hardened system was greater than that of standard resins hardened with aliphatic amines.

Applications of Wet Lay-Ups

Wet lay-up applications are not limited to carefully designed reinforced structures. One of the more interesting and successful applications is a repair kit for auto bodies. Rusted out areas, torn or ripped surfaces, and dents may be repaired quickly and easily by application of glass fabric patches impregnated with epoxy resin.

In tooling, wet lay-up epoxies are used in jigs, fixtures, paint masks, duplications, and prototypes of all kinds. Fabrication to extremely close tolerances, with excellent reproduction of detail, is possible with liquid epoxy resins.

Modifications of the wet lay-up technique are used to produce reinforced epoxy pipe and tubing capable of withstanding working pressures of 800-1,200 psi. Both centrifugal casting and mandrel-wrapping techniques employ liquid epoxy resins and glass reinforcements to make high pressure, lightweight, chemically-resistant tubular goods.

Table 3. Properties of Wet Lay-Up Laminates of ERL-2795 Resin with ERL-2793 Hardener on 181 Glass Cloth with Volan A Finish

	Non-Postcured	Postcured 8 hrs. at 160° C.*
Flexural strength, psi.	52,500	61,800
At 160° F.	7,600	46,600
After 2-hr. water boil	46,200	57,400
Flexural modulus, psi. x 10^6	2.51	3.25
At 160° F.	0.38	2.37
After 2-hr. water boil	2.29	2.79
Tensile strength, psi.	36,100	40,700
Modulus, psi. x 10^6	2.03	2.35
Edgewise compressive strength, psi.	38,100	43,000
Modulus, psi. x 10^6	2.94	2.83
Izod notched impact strength, ft.lbs./in. of notch	12.4	10.4

* Panels gelled at room temperature, no pressure.

Glass rovings and liquid epoxies are combined to form high-pressure air storage tanks for jet aircraft starting systems. Chemically-resistant ventilating hoods and ducting for chemical baths and plating tanks have been made from flat epoxy laminates assembled with glass tape saturated with an epoxy-hardener mixture.

Dry Lay-Up Laminates

Most commercial dry lay-up facilities call for impregnating the reinforcement, such as glass fabric, paper, or synthetic fibers, with a solvent solution of the catalyzed resin. For this work, most treaters use a dip tank and doctor bars or squeeze rolls, followed by solvent removal, to advance the resin to a partial cure or "B" stage. By controlling the drying and initial curing conditions, it is possible to obtain dry pre-loaded stock which can be pressed at pressures varying from bag molding pressure (10-14 psi.) to high pressures of 1,500 psi. Stability or usable life of the pre-loaded reinforcement can range from a month to over a year, depending on the epoxy/hardener system, drying conditions, and storage conditions.

Table 5 gives comparative properties of dry lay-up epoxy laminates. The ERLA-3001 and ELSA-3001 resins are catalyzed with ½% by weight on the resin solids of alphamethyl benzyldimethylamine.* This catalyst is a high-boiling liquid which is easily mixed with the resin solution. The data shown on the brittle resins (EKRA-2002 and EKRD-2003) are based on laminates hardened with stoichiometric amounts of the stripped grade of 4,4′-methylene dianiline, although equivalent properties have been obtained using catalytic quantities of certain amines. Eleven parts per hundred of 4,4′-MDA were used with EKRA-2002 resin, while 5½ parts per hundred were used with EKRD-2003 resin.

The 4,4′-MDA is a solid, but readily dissolves in the solvent used for the resins. It may be added to the resin-solvent mix before the brittle resins are put into solution, if the solution is to be used within a week, or it may be dissolved in solvent and added to the resin solution just before treating. Treating solutions of the solid resin/hardener systems have remained useful for a week after preparation. Catalyzed ELSA-3001 solutions have been useful after two to three weeks.

In the laboratory work, 181 glass cloth with Volan A finish was used. The brittle resins hardened with 4,4′-MDA were treated from solutions of 55-57% solids, while the ERLA-3001 and ELSA-301 solutions were 58-60% solids. Dip rolls and doctor bars were used to

Table 4. Properties of Wet Lay-Up Laminates of ERL-3794 Resin with ZZLA-0800 Hardener on 181 Glass Cloth with Volan A Finish

		Postcured*	
	Non-Postcured	8 hrs. at 160° C.	6 hrs. with Heat Lamp**
Flexural strength, psi.	26,980	61,200	56,400
At 160° F.	20,500	56,100	50,900
After 2-hr. water boil	53,000	60,800	50,200
Flexural modulus, psi. x 10^6	2.29	2.68	2.63
At 160° F.	0.6	2.42	2.29
After 2-hr. water boil	2.41	2.32	2.48
Tensile strength, psi.	—	—	33,700
Modulus, psi. x 10^6	—	—	1.85
Edgewise compressive strength, psi.	—	—	35,000
Modulus, psi. x 10^6	—	—	3.17
Izod notched impact strength, ft.lbs./in. of notch	—	—	10.7

* Panels gelled at room temperature and no pressure.
** Heat lamps applied immediately after lay-up.

Table 5. Properties of Dry Lay-Up Epoxy Laminates with Volan A-Finished 181 Glass Cloth*

Resin	ELSA-3001 or ERLA-3001	EKRA-2002	EKRD-2003
Curing agent	½% BDMA**	11 pph. 4,4′-MDA***	5½ pph. 4,4′-MDA***
Flexural strength, psi.	80,000-85,000	80,000-85,000	95,000-100,000
At 160° F.	53,000-63,000	69,000-74,000	70,000-75,000
After 2-hr. water boil	72,000-80,000	77,000-79,000	85,000-90,000
Flexural modulus, psi. x 10^6	3.8-4.5	3.6-3.9	4.4-4.6
At 160° F.	3.0-3.4	3.5-3.7	4.0-4.2
After 2-hr. water boil	3.7-4.3	3.4-3.7	3.8-4.0
Tensile strength, psi.	55,000-60,000	52,000-59,000	61,000-66,000
Modulus, psi. x 10^6	3.8-4.4	2.9-3.4	3.5-4.0
Edgewise compressive strength, psi.	50,000-55,000	45,000-50,000	48,000-52,000
Modulus, psi. x 10^6	4.0-4.6	3.5-3.7	3.9-4.5
Izod notched impact strength, ft.lbs./in.	11-13	12-15	16-18
Hardness, Rockwell "M"	104-108	110-112	102-107
Water absorption (24 hrs.), % weight gain	0.02-0.07	0.04-0.06	0.04-0.08
Arc resistance, sec.	150-180	140-180	155-185
Insulation resistance, (Western Electric), megohms	1-3 x 10^5	1 x 10^6	1-3 x 10^6
Dielectric strength:			
Perpendicular to lam., Cond. A, v/m	450-500	450-480	450-500
Cond. D48/50, Kv.	350-450	300-350	350-450
Parallel to lam., Cond. A, v/m	45-50	45-5-	37-42
Cond. D48/50, Kv.	40-45	40-45-	37-42
Power factor at 1 mc., Cond. A	0.010-0.018	0.015-0.018	0.010-0.014
Cond. D24/23	0.010-0.020	0.019-0.021	0.015-0.018
Cond. D48/50	0.014-0.021	0.021-0.025	0.015-0.020
Dielectric constant at 1 mc., Cond. A	4.2-4.9	4.5-4.7	4.7-4.9
Cond. D24/23	4.6-5.1	4.5-4.9	4.8-5.1
Cond. D48/50	5.0-5.2	4.6-5.2	4.9-5.2
Loss factor at 1 mc., Cond. A	0.04-0.09	0.07-0.09	0.05-0.07
Cond. D24/23	0.05-0.10	0.09-0.10	0.08-0.09
Cond. D48/50	0.06-0.11	0.11-0.12	0.08-0.10

* ⅛-in. laminates press-cured one hour at 160° C. and 400 psi.; postcured eight hrs. at 160° C.
** Alpha-methyl benzyldimethylamine.
*** 4,4′-Methylene dianiline.

control resin pickup to 33-36%. The volatile contents of the treated stocks were 0.1-0.3%, and the flows were 8-11% at the pressure used for laminating.

Changes in drying time and/or temperature permitted pressing at different pressures. For example, a commercial run of ELSA-3001 was made in which the stock was dried for seven minutes at 302° F. This material was pressed satisfactorily at 1,000 psi. In the laboratory, an oven temperature of 278° F. and a seven-minute drying time gave an ELSA-3001 stock which was vacuum-bag molded.

Shelf lives of the treated stocks to date are seven months for EKRD-2003/4,4′-MDA, five months for EKRA-2002/4,4′ MDA, and one year for ELSA-3001. These figures are the ages of the oldest samples on hand; shelf lives beyond these listed periods are expected.

The laminates were pressed for one hour at 320° F., then postcured in an oven for eight hours at 320° F. The postcure was given to improve the arc resistance, the elevated-temperature electrical and mechanical properties, and the resistance to water as indicated by the power factor after water-immersion conditioning.

As indicated in Table 5, ELSA-3001, EKRD-2003, and EKRA-2002 are satisfactory in mechanical properties for 160° F. applications; for higher service temperatures, ERL-2774/4,4′-MDA is the recommended system. All three laminates readily pass MIL-P-18177 specification requirements. An advantage of ELSA-3001 is that its low-frequency power factors are degraded by water immersion markedly less than those of the brittle resins. Laminates of ERLA-3001 have been exposed on the laboratory roof for 12 months with no sign of resin leaching and no loss of strength.

The value of postcure is shown by the elevated temperature property data in Table 6. Room-temperature properties of non-postcured laminates were only slightly lower than those of postcured pieces.

The biggest advantage offered by ELSA-3001 over other materials is the ease of handling of this low-viscosity solution. No heating or rolling of the resin in contact with solvent is necessary. The small amount of liquid catalyst and additional solvent can be added without difficulty.

Laminates of ERL-2774/4,4′-MDA made from glass cloth pre-loaded with the resin system had good mechanical and electrical properties, and exhibited good retention of room-temperature flexural strength when tested at 260-300° F. When treated for pressing at 200-400 psi., the impregnated cloth had a useful shelf life

Table 6. Effect of Postcure on Epoxy-Glass Cloth Laminates*

	Press Cure Only**	Postcured 8 hrs. @ 160° C.
Arc resistance, sec.:		
ELSA-3001	40	150-180
EKRA-2002/4,4'-MDA	80	180
EKRD-2003/4,4'-MDA	80	185
Flexural strength at 160° F., psi.:		
ELSA-3001	20,000-30,000	53,000-63,000
EKRA-2002/4,4'-MDA	58,000-62,000	70,000-72,000
EKRD-2003/4,4'-MDA	68,000-70,000	80,000-82,000
Flexural modulus at 160° F., psi. x 10^6:		
ELSA-3001	1.5-2.5	3.0-3.4
EKRA-2002/4,4'-MDA	3.2-3.4	3.8-4.0
EKRD-2003/4,4'-MDA	3.4-3.6	4.0-4.2

* Resin content, 32%.
** Press cured one hr. at 325° F. and 300 psi. from pre-impregnated glass cloth.

Table 7. Properties of Dry Lay-Up Laminates of ERL-2774 Resin with 4,4'-MDA Hardener on 181 Glass Cloth with Volan A Finish*

Flexural strength, psi.:	
At room temp.	79,000-89,000
At 260° F.	52,000-60,000
After 2-hr. water boil	77,000-82,000
Flexural modulus, psi. x 10^6:	
At room temp.	3.6-3.9
At 260° F.	3.0-3.5
After 2-hr. water boil	3.2-3.6
Tensile strength, psi.	50,000-58,000
Modulus, psi. x 10^6	3.3-3.6
Edgewise compressive strength, psi.	49,000-51,000
Modulus, psi. x 10^6	3.5-3.6
Hardness, Rockwell "M"	115-117
Izod notched impact strength, ft.lbs./in.	12-15
Water absorption (24 hrs.), % weight gain	0.05-0.07
Arc resistance, sec.	130-180
Insulation resistance (Western Electric), megohms x 10^6	5-10
Dielectric strength:	
Perpendicular to lam., Cond. A, v/m	500-550
Cond. D24/23, Kv.	—
Cond. D48/50, Kv.	400-500
Parallel to lam., Cond. A, v/m	55-65
Cond. D24/23, Kv.	—
Cond. 48/50, Kv.	42-50
Power factor at 1 mc., Cond. A	0.017-0.019
Cond. D24/23	0.010-0.025
Cond. D48/50	0.010-0.035
Dielectric constant at 1 mc., Cond. A	4.2-4.6
Cond. D24/23	4.4-4.8
Cond. D48/50	4.6-5.3
Loss factor at 1 mc., Cond. A	0.07-0.09
Cond. D24/23	0.08-0.12
Cond. D48/50	0.10-0.20

* Pressed one hr. at 160° C. (320° F.); postcured 2 hrs. at 300° F. and 6 hrs. at 400° F.

of 30-35 days when stored at ambient room temperature. Lower temperature storage would prolong this shelf-life period. Properties of this system are shown in Table 7.

ERLA-3001, the modified epoxy, is unsurpassed in toughness by any epoxy yet evaluated. However, this toughness is obtained at a sacrifice in heat distortion. The resin is finding growing use in high-quality electrical grade laminates and in electrical tubing, printed circuits, and honeycomb structures. Using the hot-melt form in contrast to the solvent solution, missile and rocket bodies are possible, as well as tubular goods in general. It is realized that these products also could be made from pre-loaded fabric.

The ERLA-3001, EKRA-2002, EKRD-2003, and ERL-2774 resin systems make strong, lightweight, good weathering, chemically-resistant structural materials. The ERL-2774 system makes possible structural materials for elevated temperature service.

Recent Developments

PRE-MIX MOLDING COMPOUNDS. A very interesting and rapid manufacturing process for reinforced plastics uses pre-mix molding compounds and matched metal dies. Epoxy resin binders for such compounds are under study at our Laboratories, and preliminary results are most encouraging. Strong structures with good gloss have been obtained using epoxy resin ERL-3794 and modified epoxy resin ERLA-3001 in combination with chopped glass fibers, mixtures of glass and vegetable fibers, and fillers such as calcium silicate.

PAPER BASE LAMINATES. After a phenolic resin pre-coat, Hurlbut 504 paper has been pre-loaded successfully with ELSA-3001 resin. The treated stock has a usable life of over one year. Laminates pressed at 1,000 psi. for one hour at 320° F. have properties which recommend them for use as XXXP-IR grade laminates. Paper-base laminates made with ELSA-3001 punch well when warm.

SYNTACTIC FOAM SANDWICH-CORE STRUCTURES. A novel method of producing low-density reinforced plastic structures which has much merit involves the use of syntactic foam, a controlled cellular plastic. By bonding the microscopic, hollow, phenolic resin spheres with epoxy resins, a uniform structure may be obtained that is reasonably free of voids, dense areas, and brittle skin.

Putty-like in consistency, uncured syntactic foam with epoxy resin binder can be pressed between glass fabric or mat to produce a finished sandwich core structure. The resin binder in the syntactic foam wets the glass on both sides giving a sandwich-type structure in one simple pressing operation. By the use of this controlled foam technique, flat boards and contour shapes are produced with equal ease. Sandwiched structures with syntactic foam cores may be easily sawed, ground, sanded, painted, and drilled.

Future Outlook

New and improved resins and curing systems are constantly under development. It is expected that many of these new developments will have direct bearing on the reinforced plastics field. Mechanical strengths, electrical properties, and chemical resistance are suitable for today's normal needs, but future developments will require further improvements.

Many new hardeners and curing agents should appear on the scene shortly. Among these will be latent curing agents and curing agents of minimum irritation potential. Other desirable developments should include resins with increased flame-retardancy and better high-temperature strengths. When these developments are accepted realities, the effect of epoxy resins on industry will be far-reaching and very rewarding. The picture looks extremely bright for this outstanding newcomer to the thermosetting resin family. —THE END

Maintenance Welding in the Plastics Industrry—Part I.
(*Continued from page 649*)

Fig. 4. Injection press cylinder head after repair of stripped threads by welding.

This electrode eliminated stress and distortion, and maintained perfect alignment.

INJECTION NOZZLES. Injection nozzles often wear or become burned in service. A New England operator has found that they are readily repaired by overlaying the damaged area with EutecTrode 6-HSS (AC-DC), a material which is applied at low heat but has high red retention qualities. It is applied easily, does not check, crack, or become porous, yet is over Rockwell C-60 in hardness. The welded area is then ground to final dimensions, and will outwear a new nozzle.

OTHER USES. A myriad of equipment must be maintained or fabricated in the modern plastics plant. Worn armature shafts are rebuilt, electrical contact points are made good as new, copper tubings are joined, special equipment is built, instruments are maintained, all with Eutectic "Low Temperature Welding Rods."

(*Continued in November*)

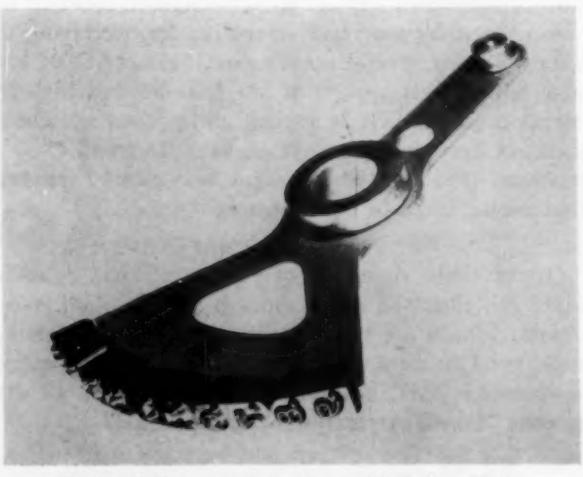
IBM Proof Machine with cover removed shows bank of printing sectors.

Phenolic-Tipped Printing Sectors in IBM Proof Machine

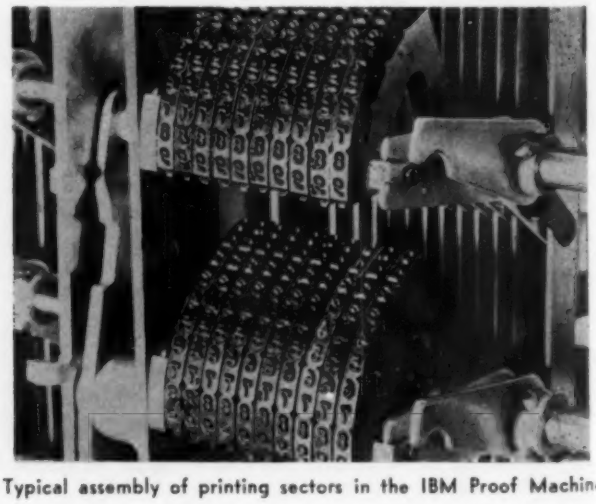
Phenolic-tipped metal inserts, molded into type, form the printing sectors of the IBM Proof Machine, a multi-functional unit capable of sorting, listing, proving, and endorsing checks of all types. The machine is capable of making as many as 32 distributions, each with an individual adding tape. All components must be dimensionally perfect.

Essential to the operating mechanism are the 440 printing sectors which print not only detailed tape listings, but also the controlled tape on which all items are listed in their original sequence. The phenolic tips, made from Monsanto Chemical Co.'s Resinox 3700, are molded on a 100-ton, semi-automatic, transfer molding press that was specially designed by the plastics molding equipment division of F. J. Stokes Corp., Philadelphia, Pa.

The Stokes press has three special plunger pots instead of the conventional single plunger, thus permitting three four-cavity molds to be run simultaneously. Fast closing speed and ram movement permit short production cycles, and prevent premature set-up of the materials. The patented bar-controller provides split-second timing of the clamping and transfer rams, plus ease of adjustment during operation. —The End



Single printing sector, showing molded phenolic tip.



Typical assembly of printing sectors in the IBM Proof Machine.

News of the Societies

Advance Program for SPE 1957 National Conference

The Society of Plastics Engineers, Inc., has announced the advance program for its thirteenth annual National Technical Conference, to be held at the Sheraton-Jefferson Hotel, St. Louis, Mo., on January 16-18, 1957.

The technical program will consist of three concurrent morning sessions on each day, three afternoon sessions on the first day, four afternoon sessions on the second day, and an evening session on the first day. In addition to technical sessions, the conference will include a membership luncheon and business meeting on January 16; the annual cocktail party and banquet on January 17; and a three-day program of activities for the ladies.

The advance program for the technical sessions is given below:

Wednesday Morning, January 16

Atomic session, moderated by David Ballantine, Brookhaven Laboratories.

"Some Vital Roles of Plastics in High Energy Nuclear Research," J. O. Turner, University of California.

"Application of a Flexible Plastic for Contamination Control," H. A. Moulthrop, General Electric Co.

"The Permeability of the Polyethylenes to Gases and Vapors," V. L. Stannett, State University of New York.

"The Corrosivities of Plastics and Rubbers," H. A. Perry, Jr., A. M. Chreitzberg, I. Silver, and H. E. Matthews, Jr., Naval Ordnance Laboratory.

Design session, Moderated by R. B. Akin, E. I. du Pont de Nemours & Co., Inc.

"Practical Methods for Controlling the Effect of Moisture on Molded Nylon," H. B. Happoldt, A. J. Cheney, and E. M. Lacey, E. I. du Pont de Nemours & Co., Inc.

"Plastics—An Answer for Industrial Design," R. Hughes, Emerson Electric Mfg. Co.

"From Appearance Design to Prototype Mold," Edward Ferrari, General Electric Co.

"Can Performance Tests Be Developed for Finished Molded Articles?" R. A. McCarthy, Monsanto Chemical Co.

Tooling and Machinery session, moderated by Islyn Thomas, Newark Die Co.

"Continuous Winding Machinery for Plastic Film and Sheeting," John D. Nordgren, Black-Clawson Co., Inc.

"The Importance of Mold Rigidity in Injection Molding," P. J. Meeks and R. N. Farris, Dow Chemical Co.

"Materials, Tooling, and Machines for Injection-Molded Packaging," B. Nathanson, Monsanto Chemical Co.

"The Engineering of Molds Utilizing Electroformed Cavities," W. J. B. Stokes, III, Electromold Corp.

Wednesday Afternoon, January 16

Extrusion-I session, moderated by Clem Young, Crescent Plastics.

"Factors Affecting Quality in Polyethylene Extrusions," B. H. Maddock, Bakelite Co.

"Flow of Polyethylene through Circular Dies," D. I. Marshall, Bakelite Co.

"Valved Extrusion," E. C. Bernhardt, E. I. du Pont de Nemours & Co., Inc.

"Effect of Blow-Up Ratio on Blown-Polyethylene Film Properties," Speaker from Spencer Chemical Co.

Injection Molding-I session, moderated by Louis F. Rahm, Princeton University.

"The Molding of Linear Type Polyethylene," F. J. Reilly, Celanese Corp. of America.

"Injection Speed Considerations," L. E. Tallman and O. G. Maxson, Dow Chemical Co.

"Uniformity Considerations for Plastic Stock Temperature in Injection Molding," A. L. Bird and Joe Eveland, Dow Chemical Co.

"Molding of Tetrafluorethylene Resin," F. M. Chapman and L. T. Bunn, E. I. du Pont de Nemours & Co., Inc.

Foams session, moderated by Arnold Varner, General Electric Co.

"Polystyrene Foam—A Low-Density Molding Material," D. L. Graham, Dow Chemical Co.

"Polystyrene—A Versatile Foaming Material," R. N. Kennedy and G. R. Franson, Dow Chemical Co.

"Plastics Sandwich Construction," G. D. Miller and H. J. Waite, Dow Chemical Co.

"Use and Application of Isocyanate Foams," Benjamin S. Collins, Nopco Chemical Co.

Educational Symposium, an evening session on "Engineering Manpower Problems," moderated by R. C. Bartlett, Natvar Co.

Thursday Morning, January 17

Injection Molding-II session, moderated by Gordon B. Thayer, Dow Chemical Co.

"Hydraulic System and Its Relation to Polymer Flow through an Injection Molding Machine," O. M. Hahn, E. I. du Pont de Nemours & Co., Inc.

"Pressure Measurement in Injection Molding—Use of Ejector Pins," P. D. Kohl, E. I. du Pont de Nemours & Co., Inc.

"A Discussion of Bulk Compressability of Polymers and Effect of This Compressability on the Flow Properties," Bryce Maxwell and S. Matsuoka, Princeton University.

"New Gating for Acrylics," J. F. Moore, Rohm & Haas Co.

Extrusion-II session, moderated by George Prall, Western Textile Products.

"Shape Extrusion Studies of Nylon Resin," K. G. Toll, E. I. du Pont de Nemours & Co., Inc.

"Rigid Thermoplastics Piping," R. K. Multer, Marbon Chemical Div., Borg-Warner Corp.

"Applications of Extrusion Theory," R. E. Colwell, Monsanto Chemical Co.

"Nylon 6 Extrusion," Speaker from Spencer Chemical Co.

Application session, moderated by Albert Lightbody, U. S. Naval Ordnance.

"Vinyl-Clad Steel," Glenn E. Wintermute, Arvin Industries, Inc.

"A Method of Testing Quality of Phonograph Records," N. J. Gifford and P. C. Woodland, Dow Chemical Co.

"New Fabrication Techniques of Flush Circuitry," P. E. Ritt, and E. I. Ditz, Melpar, Inc.

"Stability of Nylon Parts in Business Machines," Byron W. Nelson, National Cash Register Co.

Thursday Afternoon, January 17

Reinforced Plastics-I session, moderated by R. J. Savage, Celanese Corp.

"The Problems of Fittings to Match the Performance of High-Pressure Reinforced Plastic Pipe," H. D. Boggs, Fibercast Corp.

"Plastic Compressor Rotor Blades for Turbo Jet Engines," John F. Kulp, General Electric Co.

"Molding Thick Glass-Reinforced Polyester Laminates," F. Claudi-Magnussen, Hooker Electrochemical Co.

Another paper to be announced.

Instrumentation session, moderated by Don C. Walley, K-S-H Plastics.

"Watt Density and Thermocouple Location Studies on the Injection Molding Heater," R. B. Dahl and R. B. McKee, Dow Chemical Co.

"Pressure Control for Injection Molding Machines," C. E. Beyer, Dow Chemical Co.

"Platen Press Temperature Control," J. C. Stansel, General Electric Co.

"Advantages of Dual Thermocouples in Injection Cylinders and Extruder Barrels," Richard K. West, West Instrument Corp.

Compression Molding session, moderated by Edward F. Borro, Sr., Hooker Electrochemical Co.

"The Use of Alkyd Molding Compounds in Electrical and Electronic Applications,"

James J. Moylan, Barrett Division, Allied Chemical & Dye Corp.

"Advanced Tooling Techniques for Molding High-Impact Thermosetting Materials," Edwin F. Keusch, Fiberite Corp.

"Synthetic Fiber Reinforcement of Thermosetting Resin Laminates," John G. Green, Jr., E. I. du Pont de Nemours & Co., Inc.

"A Discussion of a Fully-Automatic Transfer Molding Machine," John J. Hull, Hull-Standard Corp.

Research Symposium on "Rheology of Thermoplastic Substances," moderated by Eli Haddad, Monsanto Chemical Co.

FRIDAY MORNING, JANUARY 18

Polyethylene session, moderated by John Howard, Bell Laboratories.

"Dimensional Stability of Linear Polyethylene," R. W. Miler, Dow Chemical Co.

"Linear Polyethylene as a Melt-Spun Fiber," A. T. Widiger, G. H. Youse, and T. C. Broadwell, Dow Chemical Co.

"Property—Structure Relationships in Polyethylene," H. M. Spurlin and W. O. Bracken, Hercules Powder Co.

"A Method of Evaluation of Polyethylene Molding Compounds," speaker from Spencer Chemical Co.

Reinforced Plastics-II session, moderated by Ralph Sonneborn, Owens-Corning Fiberglas Corp.

"Development of High-Temperature Resin-Glass Systems," S. G. Salzinger, Coast Mfg. Co.

"Synthetic Fibers in Formable Acrylic Sheet," Dale E. Jackson, E. I. du Pont de Nemours & Co., Inc.

"Extreme Strength Reinforced Plastics Film Systems," Johan Bjorksten and Risto P. Lappalo, Bjorksten Research Laboratories.

"Estimating in Reinforced Plastics," Frank W. Scheffler, Lunn Laminates, Inc.

Epoxies session, moderated by Jerome L. Formo, Minneapolis-Honeywell Regulator Co.

"Reactive Diluents in Epoxy Resin Systems," Elliott N. Dorman, Ciba Co., Inc.

"Epoxy Encapsulation of Transistor Flip-Flops," P. E. Ritt and R. F. Marshall, Melpar, Inc.

"Polysulfide Liquid Polymer/Epoxy Resin Compounds in Plastic Tooling Applications," Alan J. Breslau and Earl H. Sorg, Thiokol Chemical Corp.

"Manufacturing Considerations Associated with Encapsulating, Embedment, and Potting Processes," C. A. Harper, Westinghouse Electric Corp.

New York Meeting of ASME Rubber & Plastics Division

The Rubber and Plastics Division of the American Society of Mechanical Engineers will hold a one-day technical meeting in New York City on November 29, as part of the annual meeting of the parent Society. To be held at the Statler Hotel, the meeting is open to both members and nonmembers of the Society. The Division program consists of two technical sessions, one in the morning and the other in the afternoon of November 29.

The morning session will be chairmanned by C. H. Adams, Monsanto Chemical Co. and a member of the Editorial Advisory Board of PLASTICS TECHNOLOGY, with Murray Longstreth, Dow Chemical Co., as vice chairman. Four papers will be presented at this session, as follows: **"The Fundamental Mechanics of Reinforced Plastics,"** J. O. Outwater, Jr., University of Vermont; **"Penton—A New Chlorine-Containing Polymer,"** E. W. Cronin, Hercules Powder Co.; **"Electrical Effects Accompanying a Stick-Slip Phenomenon of Sliding of Metals on Plastics and Lubricated Surfaces,"** C. M. Skinner, J. Gaynor, and G. W. Sohl, all of Case Institute of Technology; and **"A Review of Developments in Plastics Engineering, 1955-56,"** Bryce Maxwell, Princeton University.

The afternoon session, also with four papers, will be presided over by Sherman Doner, Manhattan Rubber Division, Raybestos-Manhattan, Inc., with W. M. Petry, University of Akron, as vice chairman. The papers to be given are: **"Polymer Properties Involved in Process Equipment Design,"** H. J. Karam, Dow Chemical Co.; **"Roll Bending Applied to Rubber and Plastics Calenders,"** R. C. Seanor, Adamson-United Co.; **"High Horsepower Banbury Mixer,"** R. N. Comes, Farrel-Birmingham Co.; and **"Recent Developments in the Field of Mixer-Extruders,"** J. F. Drew, National Rubber Machinery Co.

SPE Newark Section

Approximately 100 members and guests, including national president Jerry Formo, attended the September 12 meeting of SPE's Newark Section, held at the Military Park Hotel in Newark, N. J. Two speakers were featured.

Albert Lightbody, U. S. Naval Ordnance Laboratory, described the functions of the Lab., especially as related to plastics. He refuted the claim that government laboratory work was not up to par with private laboratories, describing its functions as follows: new materials testing, establishing specifications, acting as consultant for other government groups, and acting as a connecting link between engineering needs and new developments in the field. The Laboratory is especially concerned, at present, with the corrosiveness of plastic materials.

William Nussbaum, CPA, related some of his experiences in plastics accounting and as a member of the SPI executive finance and accounting committee, describing the committee's efforts to obtain uniformity in cost estimating for molded parts. The differences between estimated and final costs were found to vary considerably. For example, calculated piece-weight varied from 1,336-1,518 grams; reject rate from 2-20%; and estimated cycle-time from 36-75 seconds for the same make and model of molding machine.

SPE Regional Conference

SPE's Southern California Section will hold a one-day "Symposium on Epoxy Resins," November 16, at the Institute of Aeronautical Sciences, Los Angeles, Calif. The registration fee is $5.00, which includes luncheon, and a booklet containing the symposium papers. Inquiries should be directed to the Society of Plastics Engineers, Inc., c/o Paul Erskine, 315 East Washington Blvd., Los Angeles 15, N. Y.

The program has been announced as follows: "Three Epoxy Resin Systems for Elevated Temperature Use and the Effect of Cure Cycles on Properties," R. M. Maybee, Shell Chemical Corp.; "The Chemistry of Modifiers for Epoxy Resins and Their Effect on Properties," Keith Cranker, Thiokol Chemical Corp.; "Epoxy Resin Hardener Systems," George Firth, Applied Plastics; "High-Temperature Anhydride Cures," John Delmonte, Furane Plastics, Inc.; "High-Temperature Liquid Amine Hardeners," Joseph Philipson, Chemical Process Co.; "Dermatosis and Epoxy Systems," Elliott N. Dorman, Ciba Co., Inc.; "Thermal Expansion of Filled Epoxy Resins," J. E. Carey, Shell Chemical Corp.; "Glass Fabric Finishes," Sam G. Salzinger, Coast Mfg. & Supply Co.; "Epoxy Laminates—Production Problems and Techniques," Guy Libly, Douglas Aircraft Co., Inc.; "Epoxy Laminates from Preimpregnated Reinforcements," Bruce Godard, Bakelite Co.; and "Epoxy Adhesives," John R. Boetto, North American Aviation, Inc.

SPI West Coast Conference

The Society of the Plastics Industry, Inc., will hold its annual National Conference at the Hotel Biltmore, Los Angeles, Calif., on March 18-21, 1957. In conjunction with the conference, the organization's Pacific Coast Section will sponsor a Plastics Exposition at the Shrine Exposition Hall, which will be open each afternoon and the evening of March 19.

Technical sessions will be held every morning, covering the use of plastics in electronics, aircraft and defense, packaging, building materials, appliances, sheet forming, and foams. J. Allen Carmien, Nupla Mfg. Co., has been appointed chairman for both affairs.

Perkin Centennial Report

The Perkin Centennial, commemorating the discovery of aniline dyes by William Henry Perkin, was held the week of September 10-15 at the Waldorf-Astoria Hotel, New York, N. Y. Twenty-seven profes-

ional societies participated in the Centen-ial, which featured technical discussions nd exhibits.

Of special interest to plastics processors, as the September 11 technical conference n "The Application of Colorants to Plas-ics," sponsored by the Society of the lastics Industry, Inc. Abstracts of the talks ollow:

"Colorants for Acrylic Plastics," S. C. elton, Jr., Rohm & Haas Co. The speaker ointed out that colorant selection is gov-rned primarily by the requirement of ex-reme weather stability. Since acrylics have early perfect optical clarity, their coloring s limited only by the stability of the color-ng agents. The most useful pigments, to ate, have been titanium dioxide, barium nd zinc whites, cadmium reds and yel-ows, phthalocyanine blues and greens, nd various carbon blacks. The most suc-essful dyes have been highly-purified nthraquinone derivatives.

"Ultraviolet Absorbers in Plastics," W. B. Hardy and R. A. Coleman, American yanamid Co. Yellowing and fading of lastics can be retarded by incorporating ertain compounds which absorb ultra-iolet light. These substituted orthohy-droxybenzophenones lack visible color, nd are both heat-stable and compatible with most plastics.

"The Coloring of Polyethylene," Frank J. Hines, Catalin Corp. of America. Mr. Hines described the economies available to compounders and fabricators in color-ing polyethylene. Equipment requirements range from a simple tumbling drum to Banbury-type mixers. Features to look for in a colorant are fine particle size, heat stability, absence of bleed, and non-reac-tivity. Wetting-out and pre-dispersion are of considerable assistance in obtaining good dispersion.

"Application of Colorants to Rubber and Other Elastomeric Plastics," Harold M. Whitacre, Akron Chemical Co. The four factors to be considered are the types and grades of rubber used, the accelera-tion, other compounding materials, and temperature of vulcanization. Technical considerations required for the color are high tinctorial strength, bright shade, light stability, non-migration, heat stability, non-bleed, non-crocking, color fastness to open-steam vulcanization, and freedom from ionizable copper and manganese. The prob-lems involved in coloring vinyls are much the same as for rubber.

"Polystyrene Color Standards for Fresh and Processed Food Products," George W. Ingle, Monsanto Chemical Co. Grading food products by color immediately classi-fies them by dollar value. Color grading is not new; however, the novelty of polysty-rene standards is that they represent pre-cise and durable color-matches designed specifically for visual and/or instrumental use in grading individual types of fruits and vegetables. Among the standard colors already matched in styrene are tomato red, peach yellow, and lima been green.

"The Application of Colorants to Polystyrene and Modified Polystyrene Plastics," George Godfrey, Koppers Co., Inc. Engineering data on the processing and end-use requirements of the colorants were presented. Coloring agents were listed, based on their adaptability to specific plastic materials.

SPE Kentuckiana Section

SPE's Kentuckiana Section held its first meeting of the fall season on September 19, at Evansville College, Evansville, Ind. Twenty-four members and guests were in attendance.

W. C. Warriner, E. I. du Pont de Nemours & Co., Inc., spoke on "Zytel Nylon Resin—A Versatile Engineering Material," outlining its useful properties as follows: low specific gravity; excellent wear and abrasion-resistance; impact resistance; chemical resistance; and self-lubricating properties.

Design considerations also were considered, especially with reference to the effects of temperature and moisture on tensile strength, modulus of elasticity, and dimensional stability. Mr. Warriner illustrated his talk with numerous slides and graphs.

SPE New York Section

"Tolerances and Shrinkages in Plastics" was the subject of a four-man panel discussion at the September 19 meeting of SPE's New York Section, which was held in New York City's Gotham Hotel. Over 120 members and guests attended this, the first meeting of the fall season.

"How a Molder and a Tool Designer View the Problem" was the topic discussed jointly by C. W. Kleiderer, Penn Plastics, and E. J. Csaszar, of Eagle Tool. Mr. Kleiderer felt that a single-cavity mold was necessary for dimensional testing, though many companies would not permit the added expense. Tolerances are dependent on both the materials being used and the machines, since shape and size will affect shrinkages to varying degrees. Trial and error alone can assure the perfect mold; however, a check of the electrical controls on the machines can uncover many difficulties. Mr. Csaszar stated that tool design was vital in molding to tolerances. He gave the following five reasons for imperfect parts: error in fabrication, miscalculation of shrinkage, heat distortion, mis-miter in multiple cavity molds, and use of hobbings and castings.

W. G. Turnbull, Bell Telephone Labs., spoke on **"An End-User Looks at Molded Plastics".** He described Bell's program for determining the tolerances necessary on threaded plastic parts. The firm had encountered considerable difficulty with the molded threads on phone ends, obtaining a 2-14 mils differential between threads. A rigid set of tolerances was established based on practical need.

"Control of Molding Shrinkage of Thermoplastic Materials" was covered by Arnold M. Meyer, Bakelite Co., who pointed out that thermoplastics presented greater problems with respect to shrinkage than thermosets due to their ready-formed molecular structure. The best approach to testing seems to be a single-material study, since conclusions may not apply to the field as a whole. In the case of polyethylene, orientation plays a very important role in shrinkage. As molecular weight and melt viscosity increase, so does the degree of orientation and shrinkage. An increase in material temperature reduces shrinkage by decreasing the melt viscosity and the degree of orientation. Increased mold pressure has a similar effect. Mold temperature has only a very minor effect.

"Control of Molding Shrinkage of Thermosetting Materials" was described in detail by Bakelite Co.'s Alfred J. Guzzetti, who emphasized the expenses involved in altering a mold. Thermal contraction, elastic recovery, and plastic deformation were defined, and molding variables were explained in terms of secondary effects: mold temperature, preform temperature, cure time, applied pressure, ejection time, and cooling rate. He illustrated his talk with a number of slides and graphs.

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NEWS of the INDUSTRY

Standard for Rigid PVC Sheets

A new Commercial Standard for Rigid Polyvinyl Chloride Plastic Sheets, CS201-55, has been issued, together with Amendment No. 1 to the standard, by the Commodity Standards Division of the Department of Commerce. Both the standard and amendment were proposed by the SPI Thermoplastic Structures Division.

The standard covers physical and chemical properties and methods of test for both high- and normal-impact rigid PVC sheets suitable for fabricating equipment and structures by hot forming and plastic welding techniques. The amendment covers two hallmarks which have been adopted for use by manufacturers in indentifying products conforming to the standard.

Adds Mid-Western Facilities

As part of an over-all expansion program, Plastic Molders Supply Co., Inc., Fanwood, N. J., has completed arrangements for branch offices and a production plant in Sandusky, O. Located on Columbus Ave., the new plant is scheduled to begin operations this month. The latest and most complete facilities will be available for dry-coloring all thermoplastic materials.

A. K. Van Cleef will serve as plant manager, and will also be in charge of sales. Frank Czech will be in charge of production.

Plastic Pipe Sales to Double

"Sales of plastic pipe, already at the $45-million mark, will reach $90-million by 1960," according to John Halvorsen in a speech before the American Society of Sanitary Engineering on September 17. Mr. Halvorsen is the sales and development manager of Orangeburg Mfg. Co.'s plastic pipe division; that firm being the country's leading manufacturer of bituminized fiber pipe.

He pointed out that "plastic pipe, while not intended as an over-all replacement for conventional piping materials, has numerous advantages in installations where its limited operating temperatures and pressures are satisfactory. As new resins are developed, these limits will be raised and will permit the field of applications to be expanded."

"Four types of plastic pipe are presently available: semi-rigid butyrate, rubber-resin blend, unplasticized PVC, and flexible polyethylene. The success of plastic pipe in the chemical industries, irrigation projects, institutional & municipal water systems, dairy & food industries, hotels, and homes is brought out by its 900% growth since 1948."

Borden Awarded Fischer Patent

Borden Co.'s chemical division has been granted exclusive rights to the Karl Fischer formaldehyde process by Fischer's West German engineering firm. Under terms of the contract, Borden may also license other producers. The new system is said to provide an increased yield (93% as opposed to 82-88%), and lower the utility and steam requirements for processing.

Borden uses large quantities of formaldehyde in the manufacture of thermosetting resins, and also sells it commercially. The company is increasing its number of formaldehyde plants to five, including the two units currently under construction at Kent, Wash., and Fayetteville, N. C. Anticipated total production will be in excess of 200-million pounds per year.

New Trade Name for Marblette

Maraset, a new trademark for its line of epoxy resins for plastic tooling and other applications, has been registered by the Marblette Corp., Long Island City, N. Y. Until now, the company name had been used to designate the epoxy line introduced to supplement the company's cast and liquid phenolic resins. From now on, the product lines will be separately referred to as "Marblette" phenolic resins and "Maraset" epoxy resins.

New Premises for Emet

Emet Vacuum Forming Corp. has changed its corporate name to Emet Plastics Corp. At the same time, the firm announced the acquisition of new premises at the corner of Park Ave. and East 168th St., Bronx, N. Y. The company will occupy an entire building having 20,000 square feet of floor space to house its vacuum forming facilities and services (including the design of models and molds, silk screening, decorating, and assembly).

RCI's Plasticenter features reinforced plastic entrance. Laboratory paint plant within RCI's new Plasticenter.

Reichhold Research Laboratory

A new research laboratory has been built in Elizabeth, N. J., by Reichhold Chemicals, Inc., of White Plains, N. Y. Called the Plasticenter, the lab will serve a dual function: provide technical-service information to customers; and develop basic information on RCI coating resins and plastics.

Erected adjoining the firm's Elizabeth plant, the Plasticenter features walls, ceilings, floors, and partitions which incorporate RCI resin materials. Primary purpose for the laboratory is to test products exhaustively under simulated end-use conditions. Sections and equipment include a miniature paint plant; a constant-temperature room for checking viscosity, drying, and flexibility of paints; ovens for baking finishes; a Weather-ometer; and a salt spray cabinet.

A special pilot plant is available for the development and testing of phenolic resins; also a miniature factory for manufacturing corrugated sheeting. A muller mixes the various molding compositions.

Expands Plastics Operations

Reeves Brothers, Inc., a leading textile manufacturer, has expanded its operations in the plastics field through the purchase of Vi-Plax Products Corp., Beverly, N. J., and the Garrison Co., South Plainfield, N. J. Both of the latter firms are engaged in the extrusion of plastic materials, and will be merged as a corporate subsidiary under the trademark Viplax.

Products manufactured by the new subsidiary will include rigid PVC pipe and fittings; nylon rod, tubing, and film; specialized wire coatings of nylon, Kel-F, Teflon, polyethylene, and vinyl; and a new

ne of pressure-rated pipe and fittings. The st-mentioned line will be sold to the gas nd chemical industries by Reeves' Vulcan ubber Products division.

Viplax will be combined with Reeves' resent polyethylene monofilament extru- ion operations, which was formerly under e direction of Victor L. Erlich. He be- omes vice president and director of re- earch for the subsidiary. John M. Fenlin, ormerly a senior officer of Vi-Plax, be- omes vice president and director of sales. David H. Garrison, former head of Garri- on Co., becomes vice president in charge f production.

Lunn Laminates Expands Again

Additional production facilities are avail- ble to Lunn Laminates, Inc., with the pening of another plant at Broadway in Huntington Station, N. Y. The new unit overs 5,000 square feet, and will house olding, trimming, and finishing facilities. unn's main plant is located at Oakwood oad and West 11th St., also in Hunting- on Station.

A leader in the reinforced plastics field, unn has also added sales offices at 55 W. 2nd St., New York City. The telephone umber is Longacre 5-2420.

Builds New Fabrication Plant

One of the oldest acrylic fabricators in he nation, Modern Plastics, has completed new plant adjoining the present site in Miami, Fla. The addition triples the firm's roductive capacity, and includes over ,700 square feet of floor space.

Modern Plastics plans an expansion of s custom work in the marine and indus- rial fields, as well as in aviation. Present ork covers the fabrication of acrylic, inyl, butyrate, and styrene sheet. The new orporate address is 4000 N. W. 29th St., Miami 42, Fla.

Dow Doubles Investment Figure

An investment increase from $20-million o $50-million in its Louisiana division at Plaquemine, has been announced by Dow Chemical Co., Midland, Mich. The pro- ected development will call for a payroll of 77 administrative, production, and serv- ce employes when the plant commences peration in the spring of 1958. Construc- ion employment is expected to exceed ,500 workers at the peak of the building rogram.

The Louisiana division will produce caus- ic soda, chlorine, glycols and oxides of thylene and propylene, chlorinated sol- vents, ethylene dichloride, perchloroethyl- ne and trichloroethylene, vinyl chloride, nd hydrochloric acid.

Koppers Dedicates Laboratory

Informal dedication ceremonies were held on September 18 for the 43,000-square foot development laboratory of Koppers Co.'s chemical division, Kobuta, Pa. Physical facilities include complete chemical and instrument laboratories, a polymerization laboratory, accelerated weather rooms, a machine shop, a reactor room, and offices.

A battery of machines are available for the molding and extruding of both polystyrene and polyethylene. The laboratories themselves contain the latest in equipment for material testing, plus the most modern tools for analyzing plastics and latices. Newly-developed products will be investigated at the laboratory; moved to the nearby development plant for semi-commercial production; then transferred to the large-scale Kobuta plant.

The new laboratory utilizes many of Koppers' products in its construction: wood panels are treated with the firm's special fire-retardant; roofing with Koppers' tar products; and Koppers' plastics are used in the floor tiles and in the lighting fixtures. The laboratory staff will number approximately 200, and will be under the direction of B. R. Sarchet, development manager of the company's plastics division.

Monsanto Building Conference

A conference of companies cooperating in Monsanto Chemical Co.'s "House of Tomorrow" project was held September 13 at Springfield, Mass. Fifty-two representatives of American industry presented future methods of food preparation and preservation, heating, air and sound conditioning, wall and floor covering, lighting, plumbing, and communications.

The all-day meeting was termed "the most massive and concerted creative effort in the history of building" by R. K. Mueller, vice president and general manager of Monsanto's plastics division. More than $8-billion in corporate assets were represented by the cooperating companies.

Forms New Plastics Company

R. G. Brown, vice president and a director of Lincoln Plastics Corp., has announced the formation of Norwalk Plastics Co. to take over Lincoln's plant and physical assets in Norwalk, Conn. The firm will concentrate its operations on the injection molding of thin-wall, transparent containers. Physical facilities will be enlarged, and additional equipment will be installed to broaden Norwalk's field of operations.

U.S.I. Celebrates Anniversary

Fifty years of industrial alcohol and chemical production is being celebrated October 17 by U. S. Industrial Chemicals Co., division of National Distillers Products Corp., New York City. The company's history is said to parallel industrial chemical growth in the United States.

Founded for the production of alcohol for industry under the Tax Free & Denatured Alcohol Act of June 7, 1906, the firm has since grown to a large-scale producer of chemicals such as polyethylene resins, metallic sodium, esters, ethers, ketones, intermediates, and many others. Diversification has been particularly rapid since 1951.

Republic Purchases Wikkerink

Republic Industries, Inc., Chicago, Ill., has purchased the complete assets of L. Wikkerink Co., Milwaukee, Wis., for an undisclosed figure. The latter firm had been supplying molded vinyl electric carpets to Republic's Dor-O-Matic division.

Wikkerink will continue its Milwaukee operation as the molded products division of Republic Industries, Inc. Former owner, Lance Wikkerink, will continue as chief engineer of new product development for both the division and for Dor-O-Matic.

Bridge Uses Polyester Resins

Over 35 tons of Celanese polyester resins were used as a bonding material for piles supporting a 24-mile, concrete highway bridge recently constructed across Lake Pontchartrain, La. World's longest highway bridge, it serves a major part of the $30-

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million Greater New Orleans Expressway.

The bridge was prefabricated in sections and shipped to location by barge. Huge, cylindrical piles were assembled in sections, using concrete reinforced with high-tension steel wire. Steel cables were run through core holes, and a mixture of Celanese's Marco polyester resins was applied as a bonding agent between sections. Six sections, each measuring 54 inches in diameter, made up one complete pile.

Prior to actual use, the polyesters were used to bond two test cores, eight inches in diameter by 12 inches long, end-to-end. This sample was allowed to set for 48 hours, and was then subjected to pounding by sledge hammers and chipping tools. The weld remained intact.

Reichhold Enters New Fields

Reichhold Chemicals, Inc., White Plains, N. Y., has entered three new fields within the chemical industry: petrochemicals, melamines, and plasticizers. The moves are part of the firm's long-range vertical integration program aimed at producing basic chemicals, as well as plastics.

Long-term contracts were established with Escambia Chemical Corp. which will permit RCI to produce basic petrochemicals. A new facility for the production of methanol will be constructed near Pensacola, Fla., and production is scheduled for early 1958. Reichhold manufactures polyesters, ureas, epoxies, alkyds, phenolics, protein adhesives, and polyurethanes; all of which require petrochemicals as their base material.

Full-scale production of plasticizers has been announced. Rapid expansion of phthalic anhydride production makes the manufacture of plasticizers a natural consequence, by affording a captive source of raw materials. Initially, RCI plasticizers will be manufactured and shipped from the Elizabeth, N. J., and South San Francisco, Calif., plants. Plans call for the establishment of production units at Detroit, Mich.; Los Angeles, Calif.; Jacksonville, Fla.; Charlotte, N. C.; Ballardvale, Mass.; Argo, Ill.; Azusa, Calif.; Kansas City, Kans.; Tacoma, Wash.; and Tuscaloosa, Ala.

Reichhold will manufacture melamine resins for surface coatings and adhesives under a license agreement with American Cyanamid Co. The materials will be produced at RCI's Elizabeth, N. J., Detroit, Mich., and San Francisco, Calif., plants.

Begins Sandwich-Panel Study

A one-year study of structural sandwich panels has been inaugurated by Massachusetts Institute of Technology, Cambridge, Mass. Made possible by a grant-in-aid by the market development department of Monsanto Chemical Co.'s plastics division, the study will cover cost and applications data throughout the building industry.

Lack of design and engineering information on sandwich panels leaves a serious gap in the literature of the building field. Property characteristics of the panels make them an increasingly important contender with the traditional materials, largely due to the greater emphasis on prefabrication. Manufacturers of the panels are invited to participate in the program by furnishing materials, and by appearing in a series of conferences at the Institute.

Nicolet Purchases Modigliani

Through the issuance of additional stock, control of Modigliani Glass Fibers, Inc., New York City, passed to Nicolet Industries, Inc., also of New York City. The latter firm is engaged in mining asbestos fibers, manufacturing asbestos paper, and fabricating metal products.

Guy George Gabrielson, Jr., president of Nicolet, was elected president of Modigliani, and Piero Modigliani becomes executive director of research. No change in policy is contemplated, and personnel at the Lancaster, O., plant remains the same. Expansion of production facilities and markets is under consideration.

Negotiate UCC-Visking Merger

Negotiations are presently underway whereby Union Carbide & Carbon Corp. would acquire all of the business and assets of Visking Corp., on a basis that would provide Visking stockholders one share of UCC stock for each 2½ shares of Visking. Completion of the transaction requires approval at a meeting of Visking stockholders.

Promotes Melamine Dinnerware

The market support program on behalf of melamine dinnerware, sponsored last spring by Barrett Division, Allied Chemical & Dye Corp., will be continued throughout the fall. In essence, the program calls for multi-page, full-color advertisements in "Life" magazine publicizing the brand names of the molders. This will be followed-up by trade publication advertising, a program of direct mail, and point-of-sale merchandising aids.

Durable Formed Adds Equipment

Durable Formed Products, Inc., New York City, has added the following equipment to its present facilities: a double-cylinder forming press; a multi-drawer pre-forming oven; a 20-inch band saw; and a newly-equipped tool room. The additional forming equipment gives Durable a total of 17 pneumatic double-acting presses, plus the additional five at Speck Plastics, with which the firm has a working agreement.

In Brief . . .

Monsanto Chemical Co. has opened a new office and warehouse at 6670 East Flotilla St., Los Angeles, Calif. A one-story building, the facility covers about 60,000 square feet of space. It will house more than 40 employes.

Kimball Mfg. Co. has broken ground for a $275,000 plant at San Rafael, Calif. Scheduled for completion by mid-September, the unit will occupy 30,000 square feet on a 2½-acre plot. Kimball, a subsidiary of Bristol-Myers, manufactures plastic water skis, household items, and outdoor panel trims.

The Polytechnic Institute of Brooklyn has begun converting the $2-million plant it purchased from American Safety Razor Corp., into a modern center of scientific and engineering education. Conversion costs are expected to equal the purchase price and, when finished, the structures will house over 6,000 students and the Institute's $2-million research program.

General Tire & Rubber Co.'s Bolta Products division, Lawrence, Mass., has introduced a new upholstery material called Bolta Foam-Quilt. The material consists of a vinyl face sheet, electronically heat sealed to a layer of vinyl foam and a fabric backing.

American Plastics Corp., a wholly-owned subsidiary of Heyden Chemical Corp., has begun construction of a new factory building at its Bainbridge, N. Y., plant. This is the second major expansion for the firm in 1956.

Hooker Electrochemical Co., Niagara Falls, N. Y., has consolidated its district sales offices with those of the Durez Plastics division and Niagara Alkali. The divisional offices will continue to operate as entities, but will be housed with the chemical sales offices.

Brown-Allen Chemicals, Inc., Staten Island, N. Y., has appointed Jesse S. Young Co., as its exclusive sales representative for oils, oil specialties, and plasticizers in the New York and Metropolitan area.

St. Regis Paper Co. has moved to new headquarters in the Socony-Mobil building, located at 150 East 42nd St., New York City. The move also includes the various company divisions.

Advance Solvents & Chemical, a division of Carlisle Chemical Works, Inc., has moved its executive, general, and sales offices to 500 Jersey Ave., New Brunswick, N. J.

News from Abroad

Nylon Propellers for Ships

Ship's propellers and propeller blades were among the wide variety of mechanical goods made from one type or another of polyamide shown by the Dansk Termoplastic Industri A/S, Copenhagen, Denmark, at the Tenth German Industrial Fair, held earlier this year in Hannover.

In collaboration with another Danish firm, the Jundested Motorfabrik, Dansk has been making the nylon propellers which are claimed to be as efficient as the usual metal ones and, in addition, to be stronger and much lighter in weight (specific gravity of nylon being 1.2, as against 8-9 for bronze and 2.5-3 for aluminum).

Nylon was selected for the purpose because of its high resistance to corrosion, and because it does not show the fatigue of metals. The propellers are said to be made by a rather intricate method of casting in locked molds. In tests, they withstood repeated collisions with blocks of wood. Recently, two ships equipped with nylon propellers have been sailing in the waters around Greenland to determine their behavior when in contact with ice floes.

To date, 800-mm. all-nylon propellers have been produced for pilot boats, as well as a three-bladed, 1,350-mm. diameter propeller for a 150-hp. motor trawler. Larger sizes also can be produced, but then the individual blades are made separately and subsequently mounted on a bronze or hard steel hub with the aid of bolts.

New Processing Method

A new and economic method of processing polyethylene has been developed by the N. V. Paul Schoemaker, of Deventer, Netherlands, and a German technologist. Details of the Engel Process, named after the technologist, are not available as yet, but it is known that patent applications in the name of the Dutch company have been made in some 30 countries, including the United States.

The method seems to be especially designed for the production of seamless inserts in all sizes and shapes, with wall thicknesses from 0.1-5 mm., for use in vats and drums; carboys and other containers for the chemical industry; and refrigerator wall-linings and various similar products. Well-finished inserts for vats with a capacity of 120 liters have already been made by the new process.

Swedish Plastics Exposition and Technical Conference

A plastics exposition has been scheduled for Ostermans Marmorhallar in Stockholm, Sweden, from October 27 through November 4. A technical conference will be held concurrently at the Hotel Gillet, October 27 through November 1. Sponsor for both affairs is Svenska Plastforeningen (Swedish Plastics Federation).

The exhibition hall has a total effective area of 21,000 square feet. Material suppliers will occupy the first level, processors the second, and the ground floor is reserved for machinery manufacturers. Only members of the Swedish Federation will exhibit; however, representatives of foreign firms will display Belgian, East and West German, French, American, English, Dutch, Italian, and Swiss materials and equipment.

The technical conference will feature three concurrent sessions, each consisting of 4-5 technical papers plus question-and-answer periods. The papers will be presented in Swedish, English, or German, and both American and German films will be shown.

A special informative-labelling program for plastics will be introduced, whereby each plastic material will carry a distinctive color. The label text will be short; giving the recommended name for the material, data concerning its use, and the company name. A book on plastics entitled "Kort om Plast" ("Short on Plastics") will be introduced and sold during the exposition. It will cover properties and applications of plastics, as well as a survey of the Swedish plastics industry.

Plastics in Surgery and Medicine in France

Certain plastics, chiefly vinyl plastics and nylon, are displacing rubber for various surgical applications, and are also going into new uses because of their chemical resistance, strength, lightness, and the ease with which required shapes and dimensions can be produced, combined with their low cost. The fact that their introduction into human tissues causes no undesirable after-effects, as proved by extensive tests and actual experience, have made them valuable aids in medical and surgical practice.

In France, translucent PVC prepared with a special plasticizer (not dioctyl phthalate, although PVC plasticized with this substance has been found satisfactory, too) has been used to make probes and catheters for a number of purposes. The tubes, four millimeters in diameter, can be sterilized at 118° C. for 20 minutes. Because they are inexpensive, they can be discarded after a single application, thereby helping to eliminate errors in diagnosis as well as preventing infections.

Nylon, another plastic that the human tissues seem capable of tolerating indefinitely, is being made to serve in an unusual way in cosmetic surgery. A French doctor got the idea of devising what may be termed a "subcutaneous bra" to support sagging breasts. It consists of a narrow suspensory band of fine nylon "horse hair" and what is in effect a triangular pouch of wide-meshed nylon (like fish net). The "bra" is attached *under* the skin. The operation is said to be highly effective and to leave no scars, nor have patients complained of adverse after-effects.

In France, too, hernias, including massive abdominal hernias, have been reduced with the aid of a different type of nylon net-work, known as Crinoplaque; floating kidneys also have been supported in a kind of nylon net cot; and whole sections of diaphragm, where congenitally lacking, have been replaced by nylon diaphragms.

Nylon cloth has been used in grafting large arteries; however, more satisfactory grafts are now being made from PVA foam. The method, in modified form, has also been adopted recently in England where arterial tubes are shaped from narrow strips of compressed foam material, 2-3 millimeters thick, by winding around a mandrel.

As Others See Us

Plastic articles put out by reputable French concerns need fear no comparison with similar American products, a writer for "Plastiques Informations," a French periodical, concluded after viewing recent display of such goods in the big Parisian stores. On the other hand, he thought there were things French manufacturers could learn from their American opposites in the line of merchandising.

Although the writer thought the American lamp shades shown to be in poor taste and expensive at that, and he evidently was disappointed at the lack of startling American novelties, he approved the numerous plastic bags and covers to protect all sorts of articles, especially foodstuffs, and suggested that this was an example in hygiene that could be followed.

The French writer liked the bright colors of American goods; the embossed tablecloths shown were better looking and had more "chic" than those made in France. The rolls of decorative plastic sheet, which are ready for application to any surface after the protective film on the adhesive-coated back is removed, also got his vote, as well as the attractive and astonishingly low-priced viscose rugs with latex backing. What really pleased him most and seemed most worthy of being imitated by French manufacturers was the American custom of attaching informative tickets and labels to goods, explaining what materials they are made of and how they should be used and cared for to achieve best results.

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Plastics in Australia

Although the pressure of demand eased slightly in the early months of 1956, activity in the Australian plastics industry continued at a high level, says the report of a semi-annual survey made by the Industries Division of the Australian Department of Trade for the six months ending April 1956.

The principal plastics made in Australia at present are phenol-formaldehyde, urea-formaldehyde, melamine - formaldehyde, polystyrene, cellulose acetate, and PVC. In the period under review, demand and production of phenolics dropped about 10% and output of urea resins increased, but both melamine and urea resin powders showed declines. On the other hand, demand for PVC continued to increase at the rate of about 12½% a year. PVC resins are now being made at the new plant of I.C.I.A.N.Z., Ltd., at Botany, New South Wales. This firm is the only manufacturer of these plastics in Australia. Although the granular grades are now in full production and increasing quantities of other types are becoming available, the wide variety of PVC grades demanded cannot be met yet by the existing plant and a certain amount of importation is still necessary.

At the new plant of C.S.R. Chemicals Pty., Ltd., Rhodes, N.S.W., clear polystyrene is being made on a large scale, and colored grades will be coming on the market shortly. Monsanto Chemicals (Aust.), Ltd., West Footscray, Victoria, is maintaining output levels of polystyrene, with an increasing amount of high-impact material. It is to be noted that although total demand for polystyrene has not increased greatly, consumption of the locally made material is mounting steeply, thanks to import restrictions and higher tariffs, as well as the availability of larger amounts of Australian polystyrene. Vacuum-forming sheeting is not made here as yet, and is one of the main types still imported.

Exports of plastic materials, except some thermosetting powders to New Zealand, are largely precluded because of the high prices of the Australian products.

Important new developments are in the offing. I.C.I.A.N.Z. intends to build a polyethylene plant at its 130-acre Botany works. It is expected to be able to commence production by 1958 of both high-density Alkathene HD, developed by the parent company (I.C.I.), and the low-density type. At first, industrial alcohol, relatively cheap in Australia, will be used as the base, and it is planned to produce 5,000 tons of the plastic to start with. It seems likely that PVC sponge will also be made at the Botany plant before long.

The new Beetle-Elliott factory at Box Hill, Victoria, is expected to start producing phenolics in May 1958, mainly "still" products, instead of molding powders.

Thomas De La Rue & Co., Ltd., is to establish a plant on a 10-acre site at Hornsby to produce Formica laminated plastic. A new company, to be known as Thomas De La Rue (Aust.) Pty., Ltd., is being formed, and production before the end of 1957 is anticipated.

NAMES in the NEWS

Herbert Harris

Herbert Harris has been named assistant general sales manager for Visking Corp.'s plastics division, Terre Haute, Ind. He previously served as central district sales manager, and will continue to function as same, in addition to new duties.

Albert J. Kirsch has been named technical service representative for coating resins in American Cyanamid Co.'s plastics and resins division. He previously served as chemist at the company's Stamford research laboratories.

Robert C. Davenport has accepted a position in sales with Foster Grant Co., Leominster, Mass. He formerly served as vice president and sales manager for Gregstrom Corp., and most recently as vice president and general manager of Plastic Products Corp.'s sheet forming division.

William B. Hicks has been appointed section manager in the development department of Monsanto Chemical Co.'s organic chemicals division. He will direct activities of the plasticizers, resin materials, and paper chemicals section.

J. D. Stricker has been named eastern seaboard sales engineer for Nosco Plastics, Inc., Erie, Pa., custom plastics molder. He formerly sold for competitive companies in the Ohio area.

Floyd Patrick has been named service engineer for Tenite plastics at Eastman Chemical Products' Chicago office. He replaces **John E. McKenzie,** who has been transferred to the firm's office in Dayton, O. **Joseph L. Reynolds** succeeds **William P. Gideon** as Chicago sales representative. Mr. Gideon will head up a new divisional sales office in Kansas City, Mo.

Raymond L. McCurdy has been appointed sales representative to the Cleveland district of Goodyear Tire & Rubber Co.'s chemical division. He will be concerned with applications for Pliovic and Plio-Tuf resins, as well as Plioflex styrene rubbers.

Joseph E. Butler has been appointed senior sales engineer, resin materials, for Monsanto Chemical Co.'s organic chemicals division, St. Louis, Mo. He succeeds **August R. Hemple,** who has been transferred to the division's Cincinnati office as sales representative.

Charles M. Reynolds has been appointed sales director for the newly-established sheet department, plastics division, Celanese Corp. of America. **Charles H. Edgar** succeeds Mr. Reynolds as assistant director of film sales.

Gregory J. Azarian

Gregory J. Azarian has been appointed sales manager of Colt's Plastics Co., Inc., Hartford, Conn. He previously served with Standard Tool Co., selling molds, molding machines, and mold shop accessories.

Joseph F. Morrisette has been appointed sales supervisor for reinforced plastics in the West coast area by Minnesota Mining & Mfg. Co. He will make his headquarters in Los Angeles, Calif. **Alexander L. Donaldson** has been named technical service manager for the firm's reinforced plastics division. He previously served as assistant manager of product applications in the industrial trades tape laboratories.

Richard D. Dunlop has been named executive assistant for manufacturing by Monsanto Chemical Co., St. Louis, Mo. He has been assistant general manager of the company's plastics division since 1954.

Arthur E. Young

Arthur E. Young has been appointed manager of Dow Chemical Co.'s new textile fibers department. Former assistant manager of Dow's plastics department, he coordinated activities of the team which developed Zefran fiber through pilot plant production.

John C. Hamilton has been appointed vice president in charge of manufacturing for Canadian Resins & Chemicals, Ltd., Montreal, Que. He formerly served as works manager at the firms plants in Shawinigan Falls and Ste. Therese, Que., and as general superintendent of plants.

A. G. Warren and **J. P. Nugent** have been been appointed regional sales managers for Baker Brothers, Inc., Toledo, O. Mr. Warren will direct operations in New England and the North Atlantic states, and will maintain offices in Syracuse, N. Y. Mr. Nugent takes over in Eastern Michigan and Windsor, Ont. His offices are in Dearborn, Mich.

Kyle W. Charlton has been appointed operating supervisor for Mobay Chemical Co.'s polyester department, Martinsville, W. Va. He joined the firm in January as a senior chemical engineer in the technical services department.

Russell L. Haden and **Thomas G. Gibian** have been appointed divisional managers for Dewey & Almy Chemical Co., division of W. R. Grace & Co. Mr. Haden will head the firm's organic chemicals division, and Gibian will direct the battery separator division.

J. L. Frankel has been appointed sales service representative for Advance Solvents & Chemical, division of Carlisle Chemical Works, Inc., in the New York metropolitan area. He will call on members of the paint and allied industries.

Thomas W. Trainer has been appointed special representative for American Viscose Corp.'s film division, and will work out of the Los Angeles, Calif., sales district. He also continues as technical service representative to converters and consumers.

Jean Raeburn

Leslie G. Boatright

Leslie G. Boatright has joined Escambia Bay Chemical Corp., and will devote his activities to the commercial development department in New York City. Dr. Boatright previously served as research chemist with American Cyanamid, and as manager of market development for Jefferson Chemical Co.

David A. Kressin has been named to head up Eastman Chemical Products' new sales headquarters in The Hague, Netherlands. He was previously in charge of chemical sales at Eastman's Cincinnati office. **Ralph R. Shelly,** sales representative in the New York area, replaces Mr. Kressin. **Frank W. Abernathy** has been added to the New York sales staff.

Paul H. Dillow, former Cleveland sales manager of Stahlin Brothers Fibre Works, Inc., has been named general sales manager. His new headquarters will be at the company's plant in Belding, Mich.

Kenneth A. Beard has joined General Tire & Rubber Co.'s Textileather division, Toledo, O., as assistant product design manager. For the past 19 years, he had been associated with Storey Bros. & Co., Ltd., of England, as designer and stylist.

Robert J. Sturwold and **E. B. Cook, Jr.,** have been added to the research staff of Emery Industries, Inc., Cincinnati, O. Mr. Sturwold joins the organic research section, and Mr. Cook, the process research section.

John M. Cook has been appointed field development manager by Cryovac Co., division of W. R. Grace & Co., Cambridge, Mass. He previously served as general manager of United Wallpaper's plastics & packaging division, and with Dewey & Almy.

Edward B. Dunning has been assigned to the industrial chemical development group of Archer-Daniels-Midland Co., Minneapolis, Minn. A research chemist, Mr. Dunning will evaluate fatty alcohol derivatives and their potential market.

Paul N. Cheremisinoff has been named manager of the Alsynite plant at Paterson, N. J. He replaces **Charles Opel,** who returns to the main offices of Alsynite Co. of America in San Diego, Calif. Mr. Cheremisinoff previously served as plant manager and technical director of Joseph Turner & Co.

Raymond M. Wolber has been appointed sales representative for the industrial chemicals division of Pittsburgh Coke & Chemical Co., in the Pittsburgh area. He was previously associated with U. S. Steel's coal chemical sales division.

Ernest Schleusener

Ernest Schleusener has been elected vice-president, treasurer, and a director of Rodney Hunt Machine Co., Orange, Mass. He had been vice president in charge of manufacturing for Mueller Brass Co., and, prior to that, was vice president of F. C. Russell Co., and general works manager of Brush Electronics Co.

Robert Bostwick has accepted a position in the development laboratories of Bakelite Co., Bound Brook, N. J. He formerly served with Minnesota Mining & Mfg. Co.'s Irvington division.

John H. Lambert has been named industrial resins sales representative for the Barrett division of Allied Chemical & Dye Corp., New York, N. Y. He replaces **W. H. Hough,** who was recently appointed district sales manager of Barrett's newly-formed New York district office.

John C. Garrels, Jr., has been named assistant general manager in charge of marketing, research, engineering, manufacturing, and personnel relations for Monsanto Chemical Co.'s plastics division, Springfield, Mass. He previously served as assistant general manager in charge of manufacturing.

James P. O'Connor, Jr., has been appointed sales manager of Industrial Plastic Fabricators, Inc., Norwood, Mass., manufacturer of PVC machine parts, fittings, blowers, and other fabricated units. He previously served as sales engineer with Minnesota Mining & Mfg. Co.

Robert H. Dhonau and **Arthur R. McDermott** have been added to the development and service department staff of Emery Industries, Inc., Cincinnati, O. Mr. Dhonau has been associated with the applications research group for the past ten years, and Mr. McDermott handled the sales of Emery's industrial chemicals in the Chicago area and in the Southwestern states.

Frederick K. Watson, senior supervisor in the research division of du Pont Co.'s polychemicals department, has been transferred to the plastics sales division as assistant manager of the export sales section. Dr. Watson joined du Pont in 1936 as a research chemist.

L. G. Maclise has been named supervisor of plastics sales for Dow Chemical Co.'s office in San Francisco, Calif. He formerly served as molding materials salesman with the firm's Los Angeles office.

Arthur R. Baum

Arthur R. Baum has been appointed development supervisor for Reynolds Chemical Products Co., Ann Arbor, Mich. He will head an intensive development and diversification program under way for both the plastisol and organisol divisions. Mr. Baum previously held research posts with Michigan Chrome Chemical Co., and with Sherwin-Williams.

OBITUARY

Donald L. McClure

Donald L. McClure, 49, recently-appointed general manager of L.O.F. Glass Fiber Co.'s Corrulux division, died of a heart attack on September 14, in Houston, Tex. He had left Toledo only a few weeks previously to take up his new duties.

Mr. McClure served the glass industry for over 20 years, beginning with the Tuflex department of Libby-Owens-Ford Glass Co. During the intervening years, he was foreman of the Thermolux and optical departments, plant manager of the Parkersburg, W. Va., fiber glass plant, and director of industrial relations in Toledo, O.

Born in Toledo, O., in 1907, he was graduated from Ohio State University with a B.A. in chemicary and biological sciences. Mr. McClure is survived by his wife, Doris, a daughter, five sisters, two brothers, and his mother. Services and burial were held in Toledo.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

Plasticizer Intermediate

Monohydroxyethyltrihydroxypropylethylenediamine, a chemical intermediate in syntheses of plasticizers, insecticides, and surfactants, has been placed on the market by Visco Products Co., Inc. A water-soluble alkanolamine with six reactive centers, the material is an essentially anhydrous, technical grade chemical. Properties are reported as follows:

Specific gravity at 60° F.	1.057
Boiling point, °C.	192.5
Pour point, °C.	−4
Color	Light amber
Refractive index	1.484
Viscosity, cps., at 100° C.	42
At 75° C.	190
At 50° C.	1,200
pH, 25% soln., distilled water	10.5
Solubility in water	Infinite

Readers' Service Item M-1

Two Thermoplastic Compounds

Two thermoplastic molding compounds, Cymacs 400 and 201, have been introduced by American Cyanamid Co. Based on methylstyrene and methylstyrene-acrylonitrile, respectively, the materials mark Cyanamid's entry into the thermoplastic field.

Cymac 400 has unusual heat resistance (212° F.), and possesses all the other desirable features of styrene. It is especially useful for injection-molded parts requiring exposure to boiling water.

Cymac 201 features toughness, resistance to heat, crazing chemicals, and surface marring. This compound has excellent clarity, and is light straw in color.

Typical properties are listed as follows:

	Cymac 201	Cymac 400
Compression molding temperature, °F	300-375	300-375
Pressure, psi	1,000-8,000	1,000-8,000
Injection molding temp., °F	400-550	400-550
Pressure, psi	10,000-30,000	10,000-30,000
Molding shrinkage in./in.	0.0035	0.0046
Specific gravity	1.06	1.03
Tensile strength, psi	9,000	6,600
Elongation, %	2.5	2.2
Modulus of elasticity in flexure x 10^5 psi	4.6	4
Flexural strength, psi	16,100	12,900
Impact strength, Izod, ft.lbs./in. notch	0.4	0.33
Hardness, Rockwell "M"	83	76
Heat distortion, °F	215	213
Water absorption, 24 hrs., %	0.31	0.05

Readers' Service Item M-2

Finish for Vinyl Plastisols

A decorative spray finish for most of the common vinyl plastisol formulations has been introduced by Logo, Inc. Designated N-230, the material is said to provide excellent flexibility and extensibility, along with good aging qualities. Adhesion is good, and the finish is not adversely affected by migration of plasticizers.

Non-lead bearing pigments are used due to their lack of toxicity. Colors presently available are white, black, red, yellow, and blue. Pack dry time is 3-5 minutes, depending on film thickness, and maximum hardness is obtained after 24 hours. N-230 reportedly has excellent resistance to humidity blush. Toluol and methyl ethyl ketone are recommended as thinners, and can be used in equal proportions with the finish. Recommended spray pressure is 30-90 psi.

Readers' Service Item M-3

Special Lacquer for Butyrate

A synthetic, quick-drying lacquer for coating and decorating cellulose acetate butyrate has been introduced by Schwartz Chemical Co. Designated Rez-N-Lac B, the material contains a special ingredient which alters the polarity of the plastic's surface, thereby effecting a permanent bond.

Applied by brush or spray, the material has a drying time of 1-5 minutes, depending on the thickness of the coating. Mat and satin finishes are obtained by increasing the proportion of air in relation to actual lacquer content. The coating is nontoxic, waterproof, slow-burning, and unaffected by soap oils and fats.

Rez-N-Lac B should not be used with commercial thinners containing high percentages of xylol, toluol, or mineral spirits. Specially compounded thinners are available. The lacquer is marketed in all standard colors, both opaque and transparent.

Readers' Service Item M-4

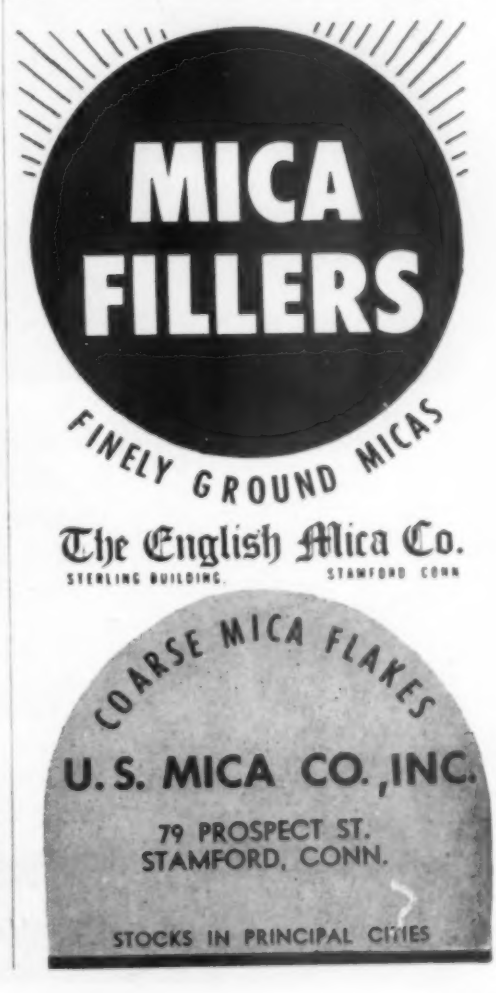
Glass-Reinforced Nylon

A glass-reinforced molding compound which features rigidity, high heat distortion, and extremely high tensile strength, has been introduced by Fiberfil, Inc. Designated Fiberfil Nylon G, the material is readily molded in standard injection molding machines which have been adapted for handling regular nylon.

Following are the physical, electrical, and chemical properties reported for typical grades:

Glass content, %	29-31
Injection molding temp., °F.	450-600
Molding pressure, psi.	10,000-25,000
Mold shrinkage, in./in.	0.005
Specific gravity	1.33
Tensile strength, psi.	12,000-18,500
Elongation, %	6.6-8.4
Flexural strength, psi.	25,000
Impact strength, Izod, ft. lbs./in. notch	2
Hardness, Rockwell M	85-95
Heat distortion temp., °F.	350
Moisture pick-up, 6-day soak, %	1.8-1.9
Dimensional change, 6-day soak, in./5 in.	0.001
Machinability	Good
Dielectric strength, short time, ⅛-in. thickness, volts/mil.	487-520
Step-by-step, volts/mil.	395-430
Dielectric constant, 60 cycles	3.99-4.03
Dissipation factor, 60 cycles	0.0155-0.021
Arc resistance, sec.	147-149
Effect of sunlight, discoloration	Slight
Weak acids	Resistant
Strong acids	Attacked
Weak alkalis	None
Strong alkalis	Fair
Organic solvents	Resistant

Readers' Service Item M-5



Polysulfide Molding Compound

A two-component, liquid system for making coldset, flexible molds has been introduced by Smooth-On Mfg. Co. Called Poly-Flex 100, the compound consists of a combination of low-viscosity liquid polysulfides and a hardening agent.

The two components are mixed in predetermined proportion and poured. Cure is effected in about four hours at room temperature. Poly-Flex can be used with plaster, wood, metal, clay, or wax patterns, and is said to be particularly suitable for casting gypsum cements. When carefully prepared, it can also be used for epoxy castings.

Plaster, Plasticene, and water-clay models should be soaped thoroughly, shined, and given a thin coating of Sonite Sealer-Release or Vaseline thinned with kerosene. Wood and metal models should be shellacked prior to coating. Most gypsum cements can be cast without any mold preparation; however, a light coating of a dilute detergent will produce flawless castings.

Epoxy resins must be protected with a film coating of a material such as Vibrin VPA polyvinyl alcohol. The resin itself should not have an exothermic heat in excess of 200° F. during cure.

Seven parts of hardening agent are used per 100 parts by weight of polymer. The mixture will begin to harden in an hour and reach working strength in 16 hours. Curing may be accelerated under low heat (below 150° F.). Physical data is quoted as follows:

Color	Tan
Elongation, Scott, %	600
Viscosity, Brookfield, 5 min. after mixing, cps.	9,700
After 10 minutes, cps.	19,500
After 15 minutes, cps.	34,200
Tensile strength, 16 hrs., psi.	130
After 24 hours, psi.	160
Pot life at 70-90° F., min.	45
Shrinkage	Negligible

Readers' Service Item M-6

Dispersed Colors for Plastics

A wide range of concentrated colors dispersed in a polymeric, general-utility plasticizer has been introduced by California Ink Co., Inc. Designated PC colorants, they are compatible with nitrocellulose, cellulose acetate-butyrate, vinyls, chlorinated rubber, polyesters, polyurethane foam, Acryloid B-72, Epon 1001 and Epon 1007.

No solvents or diluents are used, and their fine particle size assures uniformity and absence of streaking. Seventeen colors are available, seven of which are specially compounded for use with reinforced plastic boats. Pigment content varies from 25-65%; solids content, 35-75%; and weight per gallon, 9.3-17.3 pounds. The colorants are marketed in five- and 30-gallon containers.

Readers' Service Item M-7

Fluorocarbon-Felt Gasketing

Plies of mechanically-interlocked, synthetic-fiber felt impregnated with Du Pont Teflon fluorocarbon resin are laminated under high pressures to form an industrial gasketing material with outstanding physical and chemical properties. Called Teflon Vistex, the laminate is available from American Felt Co. in sheets measuring 18 by 36 inches. Thicknesses range from 1/64 to 1/16 inch.

Two types are marketed, differing with respect to gasketing action and compressive resilience. Type W is a general-purpose material with exceptionally high tensile strength, while Type NS is a moldable material suited for applications involving irregular flange surfaces and pressures.

Property data are reported as follows:

	Type W	Type NS
Weight, 1/16-inch mat., oz./sq.yd.	64	64
Density, % specific gravity	136	136
Tensile strength, min., psi	5,000	900
Elongation to rupture, %	60	250
Burst strength, Mullens, 1/64-inch, psi	150	Does not break
Porosity, % voids	0	0
Shrinkage, boiling water, %	0	0
Lateral flow, 80°F., 1-in. specimen:		
At 2,000 psi., %	0	10
At 3,000 psi., %	0	17
At 4,000 psi., %	0	23

VANSTAY Z

zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.

Plastisols, Organosols, Extruded Goods

Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.

Film, Sheeting, Molded Products

Use 1–1.5 VANSTAY HT with .5–1.5 VANSTAY Z to obtain the required protection.

When Roll plating is a problem:

Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.

Oliver

R. T. Vanderbilt Co., INC.

230 PARK AVENUE, NEW YORK 17, N. Y.

At 5,000 psi., %	0	32
At 10,000 psi., %	6	—
At 15,000 psi., %	15	—
Thermal stability at 350-430° F., psi.	1,170	515
Gasket action, 1/32-in. sample at 1,000 psi., in.	0.006	0.04
Chemical stability	Excellent	Excellent

Readers' Service Item M-8

Acrylic Thixotropic Agent

An acrylic thickener and dispersant for aqueous systems, called Acrysol ASE-75, has been introduced by Rohm & Haas Co. Containing approximately 40% solids, it converts instantly to a clear, viscous solution upon dilution and the addition of a base. The material is then added to paints, latices, textile backings, and adhesives.

Salts of Acrysol ASE-75 are also used as temporary binders, pigment dispersants, and as film-forming resins. Resultant films are highly resistant to change during aging, and can be redissolved in alkali and certain polar organic solvents.

Properties are reported as follows:

Approximate pH	3
Viscosity, Brookfield, cps.	20
Specific gravity	1.08
Appearance	Milky
Colloidal charge	Anionic

Readers' Service Item M-9

Alkylated Cresol Antioxidant

A new antioxidant for polyethylene, vinyls, polystyrene, and other hydrocarbons is being marketed by Catalin Corp. of America under license from Gulf Oil Corp. Chemically a ditertiary-butyl-paracresol, the material is offered in two grades: AC-1, a technical grade; and AC-3 for admixture in food wrappings.

The material has reportedly proved successful in preventing embrittlement and discoloration of plastic films. Properties are listed as follows:

Purity, %	98
Freezing point, °C.	68.7
Boiling range, °C.	257-265
Flash point, Cleveland open cup, °F.	260
Specific gravity	0.899
Odor	Mild
Color	White
Form	Crystal
Bulk density, lbs./cu. ft.	38
Screen analysis, 40 mesh, %	90
70 mesh, %	10

Readers' Service Item M-10

Arc-Resistant Filled Phenolic

A two-step, mineral and flock-filled phenolic molding compound has been introduced by Hooker Electrochemical Co.'s Durez Plastics division. Designated Durez 18001 Black, the material provides an arc resistance of 120 seconds plus high impact strength.

Prepared in small nodular form, Durez 18001 is a free-flowing material for preforming and for use on automatic molding machines. Dimensional stability is reported to be outstanding, and cracking around large inserts is reduced to a minimum.

Properties of the material before and after molding are quoted as follows:

Bulk factor	2.4
Density, gm./cc.	0.65
Plasticity	12
Specific gravity	1.66
Mold shrinkage, in./in.	0.004
Water absorption, %	0.4
Impact strength, Izod, ft. lb./in.	0.33
Flexural strength, psi.	9,500
Tensile strength, psi.	5,000
Compressive strength, psi.	24,000
Distortion under heat, °F.	300
Modulus of elasticity in tension, x 10^6 psi.	1.7
Hardness, Rockwell "M"	107
Ash content, %	40
Dielectric strength, short time, volts/mil	400
Step-by-step	300
Volume resistivity, ohm-cm. units x 10^{12}	1
Dissipation factor, 60 cycle	0.14
Dielectric constant, 60 cycle	10

Readers' Service Item M-11

Universal Spray Finish

Logo R-200, a spray finish for thermosetting plastics and all thermoplastics but the cellulose acetates, has been introduced by Logo, Inc. It supplies the coverage and durability of an enamel, but has the handleability, speed of drying, and finish of a lacquer.

The introduction of this universal finish is expected to reduce the finishing problems of custom molders by eliminating error in the inventory of unused finishes or coatings. Other advantages claimed for the material include more piece-parts per gallon and per hour; greater tolerances for both internal and external lubricants without adhesion failure; and absence of craze in highly strained parts.

Recommended thinners are R-266 when humidity is below 70%, and R-533 when the relative humidity is above 70%. Thinning ratio is 1:1 for most applications. Spray pressures should remain within the range of 30-90 psi. The finish has withstood a minimum of 100 hours in a Twin Arc Fade-Ometer, and one month of sunlight with no appreciable color change. Detergent and stain resistance is also reported.

Logo R-200 has resisted 25 cycles of temperature variation from 0-80° F., with no cracking or loss of adhesion, and has withstood accelerated aging for 168 hours at 158° F.

Readers' Service Item M-12

Pleasing Odor = More Sales

consider resodors*!

RUBBER

A soft talc odor helps sell baby pants. A soap-fresh fragrance adds buy-appeal to shower curtains. Hand bags with a simulated leather odor have a real competitive advantage.

Perhaps an appealing odor—or freedom from objectionable odor—is just what your product needs!

PLASTICS

developed for use in plastics and rubber. They are easy to use—just add the oil at any convenient point in your process. They'll stand up under your temperatures too.

There's a RESODOR to give your product exactly the right odor appeal. May we send you samples and put our experience to work for you?

SINDAR can give you expert assistance. Our RESODORS were specifically

* Reg. U.S. Pat. Off.

SINDAR® Corporation

Industrial Aromatics and Chemicals

330 West 42nd Street • New York 36, New York

New Equipment

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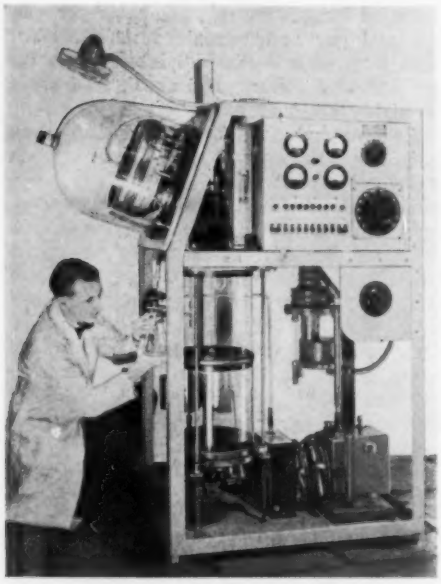


Type CMS-14 laboratory-scale still.

Centrifugal Molecular Still

The CMS-14 centrifugal molecular still, manufactured by Consolidated Electrodynamics Corp.'s Rochester division under license from Eastman Kodak Co., simulates on a pilot-plant scale the precise distillation of heat-sensitive materials obtained in costly commercial stills. Any non-corrosive material which has a molecular weight of 250-1,200, is liquefiable without molecular change, and will evaporate between 80° and 260° C. in a high vacuum, can be distilled by the CMS-14.

Features of the still include compactness, accessibility, and centralized controls. Problems of contamination, materials handling, and thermal hazard are controlled by the following: a cold trap to prevent solvents and moisture from contaminating the pump fluid; a variable-speed gear pump to control the feed rate of the distilland; pre-heating in the feed tube to speed up the process; and adjustable contact between the heated rotor and distilland.

Applications within the plastics industry include purification of monoglycerides and plastisizers, and the distillation of waxes, fatty acids, and resins. Specifications for the still are reported as follows:

Height, in.	63
Width, in.	27
Depth, in.	38
Weight, lbs.	900
Capacity, gal.	5
Distillation rate, gal./hr.	1.5
Pressure, microns of Hg.	1
Pump capacity, cu. ft./min.	1.2-4.9
Gage pressure microns of Hg	1-750
Temperature, °C	25-400
Rotor speed, rpm.	1,725
Size, sq.in.	616
Power, amps. at 120/208 volts	60

Readers' Service Item E-1

TESTED IS TRUSTED

Scott Testers* assure you authoritative, world-standard compliance with Specifications.

Whether the specifications to be met are Government A.S.T.M. or I.S.O., Scott Testers* provide universally acceptable evaluations in the form of "picturized" charts of tensile, compression, hysteresis and other tests.

Your Testing Problem is Our Business. State your problem—let us offer suggestions from our 57 years experience.

New Mooney Viscometer

Completely redesigned "Model STI" has many new features adding ease and convenience of operation in determining VISCOSITY, SCORCH and CURE characteristics.

Request "STI" Bulletin

* Trademark

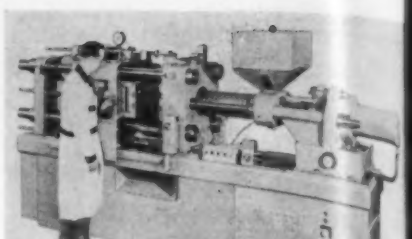
SCOTT TESTERS, INC.

149 Blackstone St., Providence, R. I.

Injection Molding Machine

An injection molding machine, designated Model 616-L-12, has been introduced by Lewis Welding & Engineering Corp.'s machine division. The latest development in the Lewis "6" series, the unit is said to offer 80% faster operating speed, 66% greater plasticizing capacity, 75% more shot capacity, 35% higher injection pressures, and an 80% increase in power plant output over previous "6" models.

Specifications are reported as follows:



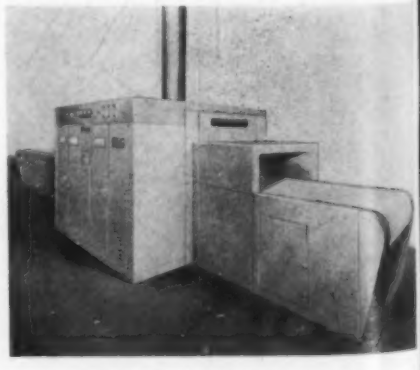
Lewis Model 616-L-12 injection molding machine.

Hopper capacity, lbs.	100
Hydraulic operating pressure, psi.	2,000
Pump combined volume, gal./min.	33
Oil reservoir capacity, gals.	100
Motor, hp	25
Length, in.	151
Width	36
Height	72
Weight, lbs.	10,500
Motor speed, rpm.	1,200
Dry cycles per hr. max. single stroke	360
Ounces (polystyrene) per cycle, pre-pack	12
Ounces (polystyrene) per shot	8
Cubic inches molded per shot	20
Plasticizing capacity/hr., lbs.	100
Diameter of injection plunger, in.	2.5
Area of injection plunger, sq. in.	4.9
Maximum pressure, psi	20,400
Stroke, in.	9.5
Rate of injection, cu. in./sec.	4
Heating cylinder, total watts	19,635
Mold thickness, max. in.	16
Minimum, in.	6
Platen size, in.	24x24
Distance between strain rods, in.	14.75
Number of clamp strain rods	4
Mold clamping pressure, tons	200

Readers' Service Item E-2

Dielectric Oven Line

A new line of dielectric ovens suitable for heating, baking, drying, and curing a wide variety of non-metallic materials has been introduced by Young Brothers Co. Five basic models are currently offered.



Model YE-30 dielectric oven.

with output ratings of 15, 30, 60, 75, and 150 kilowatts.

Since dielectric heating is accomplished by molecular agitation and friction, an even heat is created throughout the material. The 30-kw. model has a capacity of 102,000 Btu's per hour, and features an automatic load-monitor plus push-button control. All models are designed to operate singly or in tandem.

A meter indicates the electrode height in inches, and adjustment is by means of a selector knob on the control panel. The load-monitor automatically stops the conveyor when power consumption reaches the maximum permitted value, restarting it when consumption drops to a predetermined level. This latter factor permits heating of various sized objects, and prevents overloads. The water cooling system is pumped through a closed circuit.

Readers' Service Item E-3

Colson's battery-powered lift table.

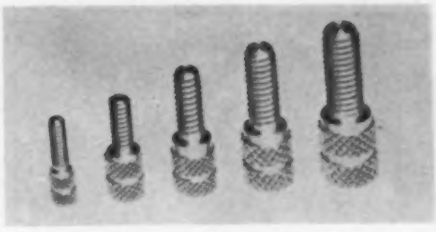
Hydraulic Lift Table

A small, battery-powered hydraulic lift table for tool and die makers has been introduced by Colson Corp. The unit has a 2,000-pound capacity and is adapted from a mechanical hand-crank model, with a hydraulic ram replacing the Acme thread screw.

The power unit is composed of a rotary gear pump with a 12-volt DC motor, and two series-connected six-volt, 130-ampere hour, 19-plate batteries. It also has a built-in, eight-ampere hour trickle charger with cut-out switch.

The table measures 26 by 43 inches, and weighs 615 pounds. Height range is 28-42 inches at a lifting speed of 11 feet per minute. A rocker-type foot pedal raises and lowers the table, and the running gear includes six-inch diameter wheels: two swivel and two fixed. A floor lock insures stability during use.

Readers' Service Item E-4



Standard's threaded studs for plastics.

Threaded Stud Insert

Threaded studs, designed to be molded into plastics, rubber, die castings, or potting compounds at the time of fabrication, have been added to the threaded insert line manufactured by Standard Insert Co. Available in brass, dural, copper, or steel, the studs are made with a knurled head to prevent rotation in use. Two circular relief bands furnish an added protection against pullout.

All regular thread sizes from #2 to ⅜-inch are available for both NC and NF threads. Class two threads are standard, but Class three threads can be made to order.

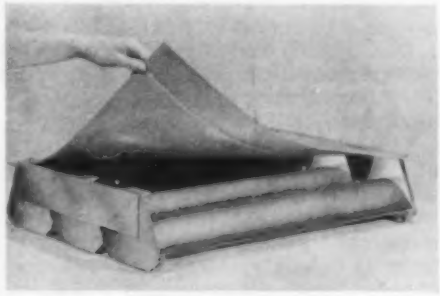
Readers' Service Item E-5

Infrared Heating Panels

Infrared panel units for forming thermoplastic sheets have been introduced by N. J. Thermex Co., Inc. Designated Infralite, the panels can be built up to desired size by bolting together the required number of standard units. A steel cover for the back completes the heater.

The panels can be wired so that sections may be turned off, an advantage when running smaller work. Unit lengths offer a variety of panel sizes accommodating sheets from eight by twelve inches (two units), to 52 by 72 inches (nine units). Over-all lengths for the panels range from 24½-78½ inches; heated lengths, 18-72 inches. Plastic sheets up to ¾-inch thick have been handled.

Infralite panels reportedly require no insulation, and are said to cost approximately one-third as much as conventional panels of the same size. Capacities of 115, 208, 230, 275, 460, and 500 volts (wattages of 750, 1,000, 1,500, 2,000, 2,500, and 3,000, respectively) are available.



Infralite controlled-heat infrared panels.

Readers' Service Item E-6

FULLY AUTOMATIC
AUTOMOLD
high speed compression molding machine

designed by molders specifically for molders' needs.

Needs no operator. Cycles continuously. Just adjust to start–refill with raw material as needed–then remove a constant stream of finished products.

Lowest first and maintenance costs. Free counsel on mold design and production. Write for brochure on 25 and 50 ton models,

AUTOMATIC MOLDING MACHINE CO.
3217B Exposition Pl., Los Angeles 18, Calif.
Dept. F

New Products

Write item numbers on Readers' Service Card to obtain more information.

Winner's new reinforced plastic boat.

Orlon-Overlaid Plastic Boat

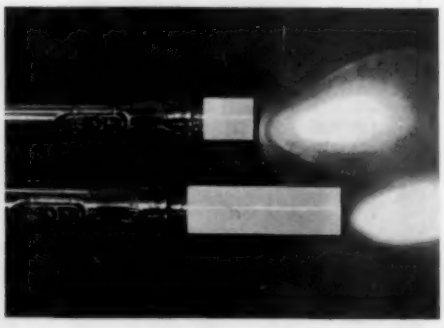
A plastic boat featuring an improved hull surface has been developed by Winner Mfg. Co. The hull is constructed by laying-up plies of reinforcing material, with Fiberglas matt as the principal reinforcement, and a batt of Orlon on the outer surface. The plies are impregnated with resin, and the hull is molded under heat and pressure.

Mechanically-bonded, non-woven batts of Orlon, Du Pont's acrylic fiber, are said to give the hull an exceptionally smooth surface and greater resistance to impact, abrasion, sunlight degradation, water, corrosion, and micro-organisms. The boat shown in the accompanying photograph is 14 feet, three inches long and has a beam of 61 inches. Depth amidships is 22 inches, and the forward deck is 60 inches long. Seating capacity is five persons.

The boat weighs approximately 360 pounds and has a motor range of 10-40 hp. Equipment includes Windshield, vinyl-covered seats, towing ring, deck cleat, bow chocks, aluminum gunwale molding, and foamed styrene flotation. The Winner line includes several models of 12 and 14-foot runabouts and utility boats. A 16-foot model in being added later in the year.

Readers' Service Item P-1

Acrylic Signal Flashlight

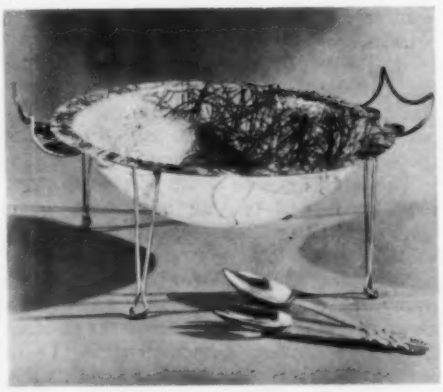


Ray-O-Vac's signalling flashlight.

The unique lighting properties of acrylics are utilized in the Traf-O-Lite signalling flashlight recently introduced by Ray-O-Vac Co. Designed for control and traffic direction in both military and civilian airport installations, police patrol work, and railroad signalling, the flashlight has a 4½-inch length of solid, cast acrylic rod mounted in the lens ring in place of the conventional glass.

In use, the rod glows like a torch, and a compact beam of white light is projected from the end. The cast rod, measuring 1¼ inches in diameter, is supplied by Cadillac Plastic & Chemical Co. A smaller model is available for automobile kits or glove compartments.

Readers' Service Item P-2



Vinyl laminate salad bowl.

Rigid Vinyl Salad Bowl

New designs in table servers, bowls, trays, and giftware are possible using random patterns fused between rigid vinyl sheets. Fabulite Products, Inc. produced the 18-inch salad bowl shown in the accompanying photograph by laminating gold and silver threads between white and clear sheets of Bakelite's rigid vinyl resin. The huge, shatter-proof bowl weighs only 4½ ounces.

These laminates provide a wide choice of design possibilities, since different colored sheets can be used as a decorative background. In addition, fluted folds and complicated shapes can be produced. The material is highly resistant to the action of water, foods, oils, and soaps.

Readers' Service Item P-3

Eastern Aerosol's rust-preventive spray.

Rust-Preventive Aerosol Spray

A rust-preventive spray for tools, dies, molds, instruments, machinery, and other metal parts has been put on the market by Eastern Aerosol Products. Known as Rust Chek, the new compound is packaged in a 12-ounce aerosol container which is said to provide approximately 80 square feet of coverage.

Rust Chek is a combination of waxes, oils, solvents, and a propellant, and is reportedly non-injurious to any metal or finish. When applied, it leaves a soft, dry, waxy film which need not be removed except on precision instruments of critical tolerances.

The resultant film is worked-off through repeated use; on power saws, it serves as a lubricant. Film thickness should be approximately 0.3-0.5 mils to assure adequate protection. The approximate time required for the film to dry is 15 minutes. Thirty days testing under humid conditions and at 100° F. showed results which conformed to Federal Specifications QQ-S-636.

Readers' Service Item P-4

Heat-Sealable Polyester Film

A heat-sealable polyester film for packaging everything from acid to precision

Sample packings with 3M's polyester film.

to protect all your vinyl products against heat and light...

Floor Tile • Film • Sheeting • Plastisols • Extrusions

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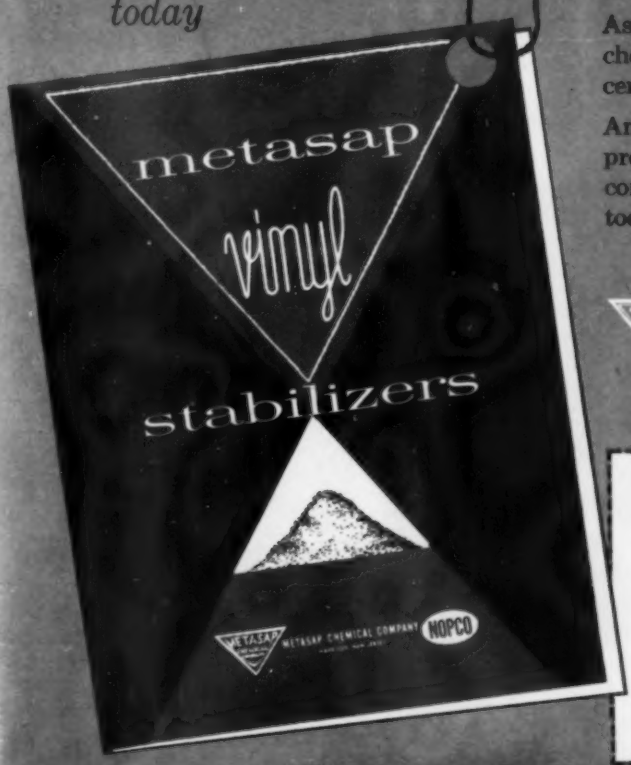

The *complete* line of Metasap Vinyl Stabilizers fully described in this new booklet are the definitive answer of the Metasap chemists to the several damaging deteriorations often found in vinyl products when exposed to heat and light.

As always, you will find that these chemists have devoted themselves to one of your central problems.

And as always, these stabilizers are prepared with the rigid quality controls you have come to expect of Metasap. Mail the coupon today for your copy.

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Gentlemen: Kindly send me your booklet "Metasap Vinyl Stabilizers".

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machine parts has been introduced by Minnesota Mining & Mfg. Co. As yet unnamed, the film is available in 4½-mil thickness, in widths up to 22 inches, and in lengths to order.

The new film is chemically inert and non-toxic, and is reported to have excellent resistance to heat, moisture, and gas penetration. Heat-sealing produces a bond stronger than the film itself. Process conditions include temperatures of 275-350° F., a 10-60 psi. jaw pressure, and ½-2 seconds dwell. Tensile strength is reported at 15 pounds per inch of width, and burst strength (Mullen) at 48 psi. The film is printable.

Readers' Service Item P-5

New Bulova President with all-styrene display box.

Polystyrene Watch-Display Box

A radically-new display box for Bulova Watch Co.'s 1956 "President" series has been developed by Bulova in collaboration with Arrow Mfg. Co. The box is navy blue, and has a clear plastic grill with an embossed presidential-type gold eagle.

Polystyrene was the material of choice, and the box was welded together by Arrow using a two-stage molding process. Light is channeled through the cover and focused on the watch, which is seated on a velvet cushion. The backdrop is white satin.

Readers' Service Item P-6

Epoxy Adhesive Kit

An epoxy adhesive kit, containing preweighed and pre-proportioned amounts of resin and hardener, is being produced by Houghton Laboratories, Inc. To assure proper mixing, the user needs only to match in length beads of both resin and hardener. This eliminates on-the-job weighing.

Houghton's trade name for its epoxy adhesives in Hysol. These adhesives form excellent bonds between such materials as

Houghton's epoxy adhesive kit.

metals, metal and wood, woods, glass, ceramics, and plastics. Complete instructions are included in the kit.

Readers' Service Item P-7

Teflon-Insulated Metal Foil

Metal foils, coated on one or both sides with a continuous film of du Pont's Teflon fluorocarbon resin, have been introduced by American Machine & Foundry Co. Called Amfoils, the developments to date have centered around 0.2-2 mil-thick aluminum. Coating thickness can be varied from 0.03-0.5 mil per side, and held to ± 10% of desired film thickness.

This combination of aluminum and Teflon produces a high-temperature (200° C.) dielectric material which is chemically inert and non-adhesive. Applications include sub-miniature capacitors, coil forms, transformers, shielding, and flexible packaging. Sheets are available in widths to 40 inches.

Insulating properties of Amfoil are demonstrated by holding the sheet around bare current wires.

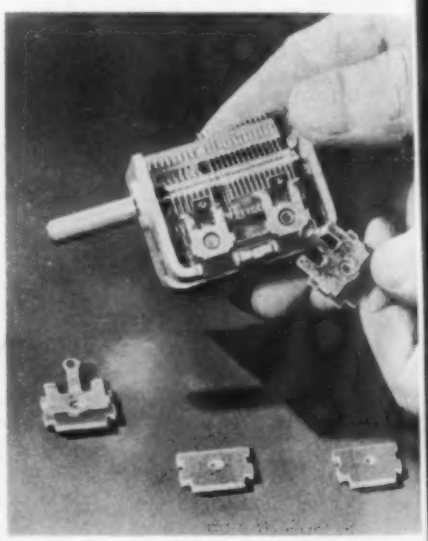
Readers' Service Item P-8

Electrical-Grade Laminate

A paper-base sheet laminate, bonded with a special phenolic resin, has been placed on the market by National Vulcanized Fibre Co. Called Phenolite E-2040, the material is intended for radio and TV applications where good electrical properties and extremely low cold flow are desired.

The new grade also features low moisture absorption (0.22-0.42%), high dielectric strength (both perpendicular and parallel to the laminations), and ease of hot punching and shearing. Other properties are reported as follows:

Flexural strength, lengthwise, 1/16-inch thick, psi	31,000
Crosswise, psi	26,300
Lengthwise, ⅛-inch thick, psi	30,200
Crosswise cut, psi	23,100
Impact strength, ⅛-inch sample, ft.lbs./in.	0.56-0.6
Density	1.37
Rockwell "M" hardness, cold	117
Hot, 60 sec	82
120 sec	107
Cold flow, Divisions change	8.1



Phenolite E-2040 used as terminal insulators for variable condenser.

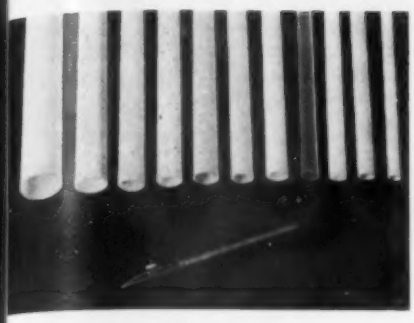
Phenolite E-2040 is available in sheets up to 39 by 47 inches, and in thicknesses from 0.01-0.25 inch. Color is natural; finish, dull.

Readers' Service Item P-9

Tempertube Nylon Pipe

The newest addition to its Danco line of nylon products, Tempertube nylon pipe, has been announced by Danielson Mfg. Co. Supplied in straight lengths or continuous coils, the piping is available in sizes from ⅜-1½ inches outside diameter, and in wall thicknesses from 0.025-0.125 inch.

Two types of nylons are used by Danielson for their piping: Zytel 42 and capro-



Danielson's Tempertube nylon piping.

laptam. The former is said to offer fabricating advantages over standard Zytel 101, and provides slightly higher tensile and impact strength. Caprolaptam tubing is the easiest to bend, and has superior resistance to bruising and impact.

Properties are reported as follows:

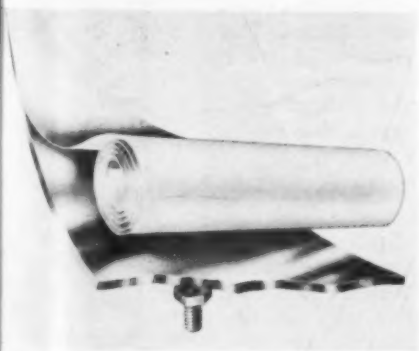
	Tempertubes	
	Zytel 42	Caprolaptam
Tensile strength @ —67° F., psi.	15,700	14,900
At 73° F.	11,200	10,200
At 158° F.	7,600	7,400
Stiffness @ 73° F., psi.	200,000	140,000
Impact strength @ 73° F., ft. lbs./in.	1.1-1.5	1.8
Flow temperature, °F.	480	420
Heat distortion temp., 66 psi., °F.	360	1.14
Specific gravity	1.14	318
Expansion per °F., 10^{-5}	5.5	4

Readers' Service Item P-10

Thin Cementable Teflon Tape

Cementable Teflon tape is presently available from Garlock Packing Co., in thicknesses as low as 0.005-inch. Possessed of all the properties of Teflon, du Pont's fluorocarbon resin, the tape is used for lining conveyor guide rails, hoppers, baking pans, cookie flats, and corrosives containers.

The tape is supplied in continuous rolls measuring 0.005-0.06 inch thick, and in widths from ½-12 inches. Sheets, 24 by 24 and 48 by 48 inches, are also available. The tape is slippery on one side, and specially treated on the other side for ease of bonding. Garlock 201 adhesive is recommended.



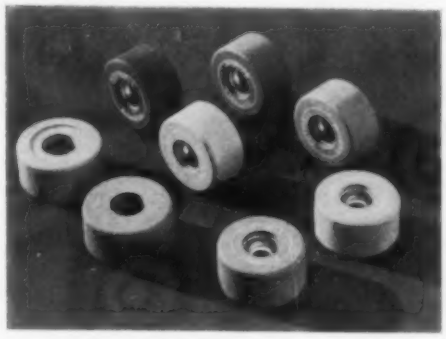
Teflon tape being applied to conveyor guide rails.

Readers' Service Item P-11

Rubber-Phenolic Skate Wheels

The noise level of roller skating is cut 75% with the new Silentred skate wheel produced by Cottrell, Inc. Compounded from B. F. Goodrich's Hycar synthetic rubber and Durez phenolic resin, the wheels give free-rolling silent speed and are highly wear-resistant.

Silentred wheels will not slip on any type of skating surface, thereby eliminating the need for powdering wooden rink floors. Two specific types are produced: precision wheels for the expert skater, and open-bearing wheels for the racer and average skater. They both have excellent resistance to oil, grease, gasoline, chemicals, heat, cold, and abrasion. A wide range of colors is available.



Rubber-phenolic skate wheels are non-slip and silent.

Readers' Service Item P-12

Bolta Foam-Quilt makes an attractive auto seat cover.

Vinyl Seat Cover Material

A combination cushioning and seat covering material called Foam-Quilt has been introduced by General Tire & Rubber Co.'s Bolta Products division. It consists essentially of a vinyl face sheet, electronically heat-sealed to a layer of vinyl foam, and a fabric backing.

Style wise, the material resembles the expensive tufted and quilted coverings. The foam is fire-resistant, and thoroughly compatible with the Boltaflex face sheet. Foam-Quilt can be used in matching or contrasting color combinations to produce effects similar to the one shown in the accompanying photograph. Highly resistant to stains and scuffs, it wipes clean with a damp, soapy cloth.

Readers' Service Item P-13

vive la difference

"Difference" is probably the most intriguing characteristic of GREX polyethylene. For instance . . . the difference between GREX and many present day plastics whose sprawling molecular form is suggested above. In contrast with this loose arrangement, GREX presents a close-knit, orderly pattern of molecules. Result: greater strength, better resistance to heat distortion, and a far lower vapor transmission rate. GREX will be available commercially in mid-'57.

GREX*

Clifton, N. J. Baton Rouge, La.

*Trademark for W. R. Grace & Co.'s polyolefins

POLYMER CHEMICALS DIVISION
W. R. GRACE & CO.

New Literature

Write item numbers on Readers' Service Card to obtain more information.

"Metasap Vinyl Stabilizers." Metasap Chemical Co. 6 pages. This bulletin consists essentially of a table of properties and suggested uses for 17 Metasap stabilizers.

Readers' Service Item L-1

"Injection Molded PVC Self-Lubricated Plug Valves for Corrosion Service." Tube Turns Plastics, Inc. 4 pages. This folder describes, illustrates, and lists dimensions for Tube Turns' all-PVC plug valves.

Readers' Service Item L-2

"ASCO Solenoid Valves." Condensed Valve Catalog No. 201. Automatic Switch Co. 32 pages. Included in this catalog are engineering data, flow charts, operation and construction details, illustrations, prices, and a selection chart.

Readers' Service Item L-3

"Geon 8700-A and 8750." B. F. Goodrich Chemical Co. 8 pages. The booklet deals specifically with use of these resins in the manufacture of rigid vinyl pipe and fittings, and includes two charts covering physical properties and chemical immersion data. Application photos are included.

Readers' Service Item L-4

"Hobbs Model MD Slitter & Rewinder." Hobbs Mfg. Co. 4 pages. An illustrated resume of the machine, giving specifications and functions. Four sizes are available: 40-inch, 50-inch, 60-inch, and 72-inch.

Readers' Service Item L-5

"Acrylonitrile Storage and Handling." Technical Service Bulletin No. RM-20. Monsanto Chemical Co., plastics division. 4 pages. Since the material is both toxic and flammable, various techniques have been developed for its storage and handling. Considered here are design of storage tanks, piping, pumps, valves, filters, drum storage, and other safety precautions. A property data sheet is included.

Readers' Service Item L-6

"Resin Coated Sand Process for Foundry Shell Molds and Shell Cores." Product Information Bulletin No. 1022. Monsanto Chemical Co., plastics division. 16 pages. Advantages over resin-sand mixes are reported as elimination of dusting, improved flow, excellent blowability, economy, reduction or elimination of pattern lubrication, and non-segregation of resin and sand during storage. Techniques are illustrated in detail.

Readers' Service Item L-7

"Equipment for the Plastics Industry." Stewart Bolling & Co., Inc. 8 pages. Spiral-Flow mixers, roll mills, presses, and calenders are described and illustrated, together with specifications.

Readers' Service Item L-8

"Spiral-Flow Intensive Mixers for Rubber and Plastics." Stewart Bolling & Co., Inc. 12 pages. This illustrated bulletin describes the line and gives specifications. A typical installation blue print is included.

Readers' Service Item L-9

"Polyglas Reinforced Plastics for Industry." Bulletin 56. Modular Plastic Corp. 4 pages. Typical applications are described, and a table of chemical resistance is included.

Readers' Service Item L-10

"Comet Sheet Plastic Forming Machines." Comet Industries. 10 pages. Specification data on four machines are included in this bulletin, together with photographs and two pages of price listings.

Readers' Service Item L-11

"PE-64 Preplasticizing Type Injection Molding Machine." Bulletin 624. Watson-Stillman Press Division, Farrel-Birmingham Co., Inc. 6 pages. Operating features and specifications for the machine are given, along with a description of the improved cylinder, base design, prefill system, preplasticizer unit, and accessory equipment which have been incorporated.

Readers' Service Item L-12

"Plastics for Electronics." Emerson & Cuming, Inc. 7 pages. Five one-page technical bulletins on Eccosorb microwave absorbers, a price sheet, and a flyer on Stycast casting resins, impregnants, laminating resins, and plastic foams are included in this folder.

Readers' Service Item L-13

"Lubricants for Vinyl Processing." Application Newsletter #28. Baker Castor Oil Co. 2 pages. Descriptions of Lubricin V-1, V-2, and V-3; Paricins 8 and 28; and Estynoxes 300 and 308 are given in this bulletin.

Readers' Service Item L-14

"Optical-Electronic Instruments for Process and Quality Control." Kaye Development Co. 8 pages. This combination catalog-application notes folder describes and illustrates the firm's spectrostats, the trichrometer, and the turbistat which are used to measure and control spectral deviation and absorption, and measure on-stream turbidity. Block diagrams are included.

Readers' Service Item L-15

"Unplasticized PVC Pipe Fittings and Flanges." Albert Pipe Supply Co.,Inc., 11 pages. Characteristics, physical properties, fabrication methods, and advantages of unplasticized PVC are outlined. A catalog of the firm's products is included, together with size schedules and a listing of their chemical resistance to a host of reagents.

Readers' Service Item L-16

"Metasap Metallic Soaps." Metasap Chemical Co. 32 pages. The soaps are defined together with their properties and uses. A bibliography of technical and patent literature on the subject is included.

Readers' Service Item L-17

"Derbylite Fluorescent Pigments." Luminous Resins, Inc. 6 pages. Twenty-four color chips are displayed, together with comments on the history of fluorescence and a description of the company's products in that field.

Readers' Service Item L-18

"Copper Clad Fluorocarbon Plastic for Printed Circuitry." AR-2a. International Resistance Co. 2 pages. Laminate properties and proposed types are discussed in this flyer. Electrical properties of fluorocarbons are listed, and dielectric constant and dissipation factor are plotted against frequency.

Readers' Service Item L-19

A SHOVEL IS TO DIG

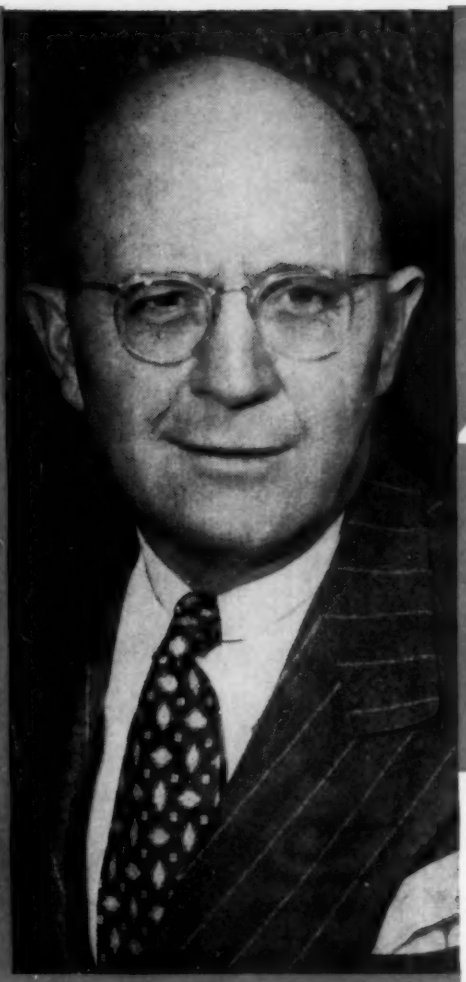
In these words a child expresses the very essence of function, by-passing conventional definition of an object.

Would there were as simple a way to express the vital function of a business publication! You could say, "a business paper is to read," but that hardly does justice to a service that:

...assembles information pertaining to a given field
...condenses it for quick absorption
...interprets significant developments
...delivers the whole package regularly in attractive form
...and in doing so provides a vehicle that enables suppliers to talk to a selected group of business men in their own language and in terms of their special interests.

Perhaps the word "service" is the key. Perhaps the phrase we're searching for is a simple one, after all: *a business paper is to serve.*

On the following pages, *L. A. McQueen,* Vice President of Sales, GENERAL TIRE & RUBBER COMPANY, tells how he feels about the services business papers perform.



"BUSINESS PUBLICATIONS ... EQUALLY VITAL IN

says L. A. McQueen
Vice President of Sales
General Tire & Rubber Company

The General Tire & Rubber Company

MAIN OFFICE AND FACTORY - AKRON, OHIO

Mr. Britt Wilson
Bill Brothers Publications
New York

Dear Mr. Wilson:

Knowledge of business does not come easily, nor does it come all at once. A businessman, if he is going to stay in his field, had better be interested in that business and he had better be inclined to read as much as he can about it.

True, nothing can replace experience as a teacher, but I discovered long ago that the store of information and opinions of others drawn from business publications was an asset also.

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We constantly focus attention on General's tire developments through business magazine publicity and advertising, because we know these news organs are read by our customers and our prospective customers. Similarly, we concentrate on chemical, aviation and plastics trade papers for the presentation of our new products.

Cordially yours,

THE GENERAL TIRE & RUBBER CO.

L. A. McQueen
Vice President of Sales

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Bill Brothers publications sponsor this series of messages as a service to those who benefit from reading good business publications and those who benefit from advertising in them ...often the *same* business men.

We have asked prominent business men to express their own concepts of the business press as an educational force and as an adjunct to sales operations. You'll agree, we're sure, that their ideas apply to *all* good business papers serving business men in all of America's industries, professions and trades.

Glad to send you reprints of their statements, as we publish them. Just get in touch with any one of the Bill Brothers publications listed at the right.

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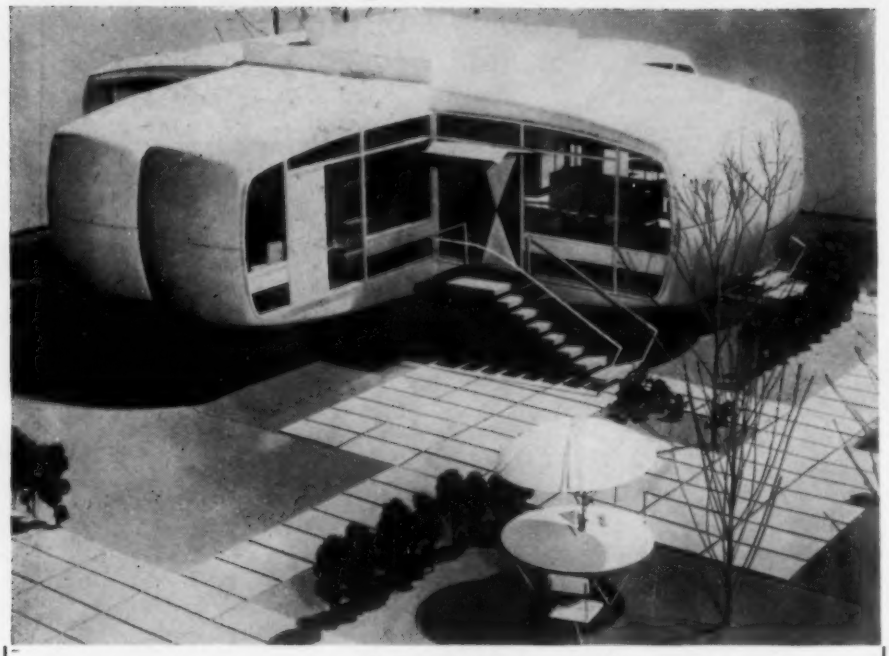

Monsanto Chemical Co.'s "House of Tomorrow"

Design, development, and research engineers key to reaching the plastics industry.

Today, plastics has far outgrown its "Gadget Age." Many firms who formerly used other components are switching to today's plastics —for tooling, radar canopies, railway compartments, irrigation and fuel pipe lines, and thousands of other engineered products.

With these fast-moving developments, the plastics design, development, and research engineers have assumed a specialized importance. Recent industry surveys demonstrate that this group not only specifies the products to be used, but exerts the greatest influence on the purchase of raw materials, equipment, and services in the plastics industry.

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Book Reviews

"Theoretical Investigation of the Mechanisms of Transfer of Materials Through Polyethylene." H. A. Bent and Jules Pinsky, Wright Air Development Center. Order PB 121194 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 93 pages. Price, $2.50.

Equations for the permeability of polyethylene are given, together with master plots for interpolating homologous materials and extrapolating for temperature changes. The bibliography includes data on permeability, solubility, and diffusion in polymer systems.

"The Theory of Plastic Plates." W. Prager, Office of Naval Research. Order PB 111943 from OTS, U. S. Department of Commerce, Washington 25, D. C. This report discusses problems relating to circular plastic plates under rotationally-symmetric conditions of loading and support. It also serves as an introduction to the literature on the subject, some of which are not readily accessible.

"Organic Chemistry." Third Edition. Louis F. Fieser and Mary Fieser. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Cloth, 6½ by 9½ inches, 1117 pages. Price, $10.00.

The principles and concepts of modern organic chemistry are considered together with their applications in the various fields of technology and medicine. New developments since the second edition (1949) are included, particularly with respect to fatty acids, alkaloids, isoprenoids, tropolones, steroids, antibiotics, peptides, and enzymes. Use of tracers and microbiological techniques are described in detail.

New concepts of conformational analysis are discussed, along with the molecular orbital theory. Molecular mechanisms of ionic and free radical reactions are cited throughout the text. Problems are given at the end of each chapter; answers appearing at the back of the book. Author and subject indexes are included.

"Polyesters and Their Applications." Johan Bjorksten, Henry Tovey, Betty Harker, and James Henning. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Cloth, 6 by 9 inches, 626 pages. Price, $10.00.

A comprehensive survey of the entire polyester field, the text covers raw materials to fabricated products. The saturated polyesters used in the production of fibers, films, elastomers, and foams are covered; as are the unsaturated polyesters used in molding, casting, coating, impregnating and laminating.

Theoretical considerations are discussed first; the chemistry of combining dicarboxylic acids with dihydroxy alcohols; the use of cross-linking agents, solvents, and inert gases; and the actual resin manufacture. Other chapters cover catalysis and inhibition, fillers and reinforcements, shaping, finishing, commercial resins, tailor-made polyesters, and final products.

Test methods and health hazards are described in detail, and an annotated bibliography covers patents, magazine articles, books, and manufacturers' literature. Author and subject indexes are included.

"Propylene—Chemical Safety Data Sheet SD-59." Manufacturing Chemists's Association, Inc., 1625 Eye St., N. W., Washington 6, D. C. Paper, 8¼ by 10¾ inches, 18 pages. Price, 30¢.

The booklet lists physical and chemical properties, plus other essential information on the safe handling and use of propylene, a flammable, compressed gas normally handled in liquefied form under pressure. Hazardous properties, unloading and emptying, storage, ventilation, engineering controls, and personal protective equipment are discussed.

"The Chemistry of Phenolic Resins. The Formation, Structure and Reactions of Phenolic Resins and Related Products." Robert W. Martin. John Wiley & Sons, Inc., 404 Fourth Ave., New York 16, N. Y. Cloth, 6 by 9½ inches, 309 pages. Price, $9.50.

Written from the organic chemist's viewpoint, the book considers the chemistry of a reaction rather than the performance of the end product. Each major type of phenol-aldehyde and phenol-ketone reaction is considered separately, and available data are presented in a systematic fashion. Overall subject matter covers not only phenolic resins, but other related compounds such as phenol alcohols, dihydroxydiphenylalkanes, and dihydroxybenzyl ethers.

Cure, heterocyclic products, joint reactions with a third reagent and with unsaturated compounds, reaction kinetics, and reactions of phenolaldehyde products are considered in separate chapters. A summary of the results of reaction-rate studies is included. Structural formulas are given in each instance, and an annotated bibliography is appended to each chapter. An extensive subject index is included.

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Abstracts of Important Articles

Materials

"Modifications of Plastics by Irradiation," J. van Leeuwen, *Plastics*, 9, 4, 210; 9, 4, 272 (April and May 1956).

This paper was written following two lectures given in Holland last fall by Dr. F. Charlesby on the modification of polymers by means of high-energy irradiation. Dealing in particular with polyethylene, the article explains the types and sources of radiation employed, the chemical reactions in the polymer and the changes in properties effected, and the economic prospects of the method. (In Dutch.)

"Heat Treatment of Polyamides—Investigation of the Structure of Parts Made by Injection Molding and Other Processes," J. Leeuwerik, *Plastica*, 9, 2, 90 (Feb. 1956).

In producing polyamide parts by extrusion, injection molding, casting, or flame-spraying, it is difficult to achieve a fine-grained crystalline structure throughout. A coarse-grained structure or the presence of an amorphous surface layer lowers the mechanical properties. How structure is to be examined, some of the causes of unsatisfactory structure, and preventive measures are briefly discussed. For difficult cases, thermal after-treatment has been found effective. (In Dutch.)

"Impact and Heat Resistant Polystyrene," S. Pezarro, *Plastica*, 9, 5, 252; 9, 6, 319 (May and June 1956).

The development of normal, impact, and heat-resistant polystyrene is reviewed, and the different types compared with normal polystyrene. The products available in Holland under their brand names, and the foreign manufacturers and their local representatives are listed at the end of the article. (In Dutch.)

"Studies on the Cementing of Packaging Materials. The Influence of Joint Thickness on Joint Strength," W. Bartusch, *Kunststoffe*, 46, 6, 274 (June 1956).

An empirical relation is developed which permits a mathematical description of joint strength in relation to joint thickness, and the calculation of optimum joint thickness. The decline in tensile strength as the thickness of the joint increases is assumed to be due primarily to molecular orientation which takes place in the marginal layers of the adhesive under the influence of shrink stresses during setting. (In German.)

"Measuring Changes in Pressure and Volume to Determine Gas Permeability of Plastic Film. Part II. A New, Highly Sensitive Instrument," W. Schrufer, *Kunststoffe*, 46, 6, 270 (June 1956).

The instrument, developed on the basis of considerations set forth in Part I of this paper, is intended for measuring gas permeability of plastic film and of papers coated only on one side. Since it is simple to operate, the device is suitable also for factory measurements. (In German.)

"Cold Stretching of Low-Pressure Polythene," K. Richard and E. Gaube, *Kunststoffe*, 46, 6, 262 (June 1956).

The stress-strain diagrams of low-pressure polyethylene at room temperature and at temperatures from 22-124° C. are discussed in detail; the processes taking place within the material during stretching are explained; and the tensile properties considered. It is observed that the stress-strain diagram of high-pressure polyethylene is fundamentally of the same type as that of the low-pressure material, and at room temperature the diagram of the former resembles that of the latter at higher temperatures. So-called "cross-stretching" of already-stretched materials in a direction at right angles and at other angles to the first stretching receives special attention. Finally, the behaviour of the material subjected to biaxial stress is dealt with. (In German.)

"Polyethylene Terephthalate Fibers," F. Beek, *Plastica*, 9, 3, 120 (March 1956).

The production of polyester fibers, as well as their properties and applications, are described. (In Dutch.)

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines will be printed here quarterly.

The next complete listing will appear in December.

—The Editor

"Aluminum - Plastic Laminates," K. Broockmann and R. Schnell, *Kunststoffe*, 46, 6,244 (June 1956).

The special advantages conferred by the use of aluminum are explained. Among these are the prevention of "heat storage," as demonstrated by experiments. The various processes that have been developed for making the plastic-aluminum laminates, mostly with polyethylene, as well as their bonding problems are discussed. Tests showed the relation of processing temperature to adhesion. Except in the case of a polyvinyl ether plus polyisobutylene adhesive, application of adhesives to the dull side of rolled aluminum foil gives better results than when applied to the shiny side. (In German.)

"Nitroparaffins in the Plastics Industry," A. M. Cooke, *Western Plastics*, 3, 6, 17 (June 1956).

A discussion of uses and potential uses of nitroparaffins in plastics manufacturing, compounding, fabrication, and finishing.

Equipment

"Extruders with High Speed Worms," E. Beck, *Kunststoffe*, 46, 1, 18 (Jan. 1956).

The principles underlying the development work on a new type of extruder, for which patents have been applied, are discussed. The special features of this machine are unusually high circumferential speed, and control and maintenance of stable extrusion conditions through variations in the viscosity of the compound instead of through temperature as is customary. A model of the extruder was used in the tests described. (In German.)

Mold Design for Injection Molding Machines," H. Gastrow, *Kunststoffe*, 46, 1, 41 (Jan. 1956).

Molds for parts with external undercuts. (In German.)

"The Engineering of Purchased Molds," J. C. O'Brien, *SPE J.*, 12, 7, 17 (July 1956).

Some of the problems associated with the use of purchased molds are discussed, together with methods for minimizing these problems. It is suggested that the best interests of the industry and its customers are served when engineering responsibility is retained by the molder.

Processing

"Barrel Finishing Methods for Plastics," E. C. Emslie, *Plastics (London)*, 21, 222, 28 (Jan. 1956).

For finishing plastics by barreling or tumbling, the author prefers a barrel of octagonal shape, and hardwood pegs or cubes impregnated with a polishing cream. The techniques of wire-mesh barreling, self-barreling (in which water and a detergent are used), and dry processing are treated in detail.

"Automatic Sheet Forming," D. A. Davis, *Modern Plastics*, 33, 12, 119 (Aug. 1956).

Description of a forming plant where automatic machines save in floor space and labor, and improve the product.

"Casting Plastics Sheets," J. O. Beattie, *Modern Plastics*, 33, 11, 109 (July 1956).

Detailed procedures are given for casting, curing, and annealing sheets made of acrylic esters, styrene, allyl esters, and phenolic resins and copolymers.

"Injection Molding Efficiency and the Importance of Gating," E. Gaspar, *Trans. Plastics Inst.*, 24, 55, 26 (Jan. 1956).

Gate design is a very important factor in achieving optimum molding conditions. However, gate performance and efficiency depend largely on the efficiency of the molding machine itself, cavity pressure, temperature control, and rate of injection. These points, as well as runner and gate design, pin-point gating, and gate location, are treated and several recommendations on gating are made.

"Marking, Printing and Decorating Plastic Packaging Materials," M. Cottet-Emard, *Pensez Plastiques*, 37, 7 (March 1956).

A discussion of the most usual methods of producing designs or inscriptions on plastic materials, including embossing, molding, marking or stamping, offset printing, and silkscreen printing. (In French.)

"Direct Weaving of Tubes and Hollow Rods of Reinforced Polyester Resin," J. A. Taviere, *Ind. Plastiques Mod.*, 7, 10, 34 (Dec. 1955).

The author critically considers the various methods employed for making glass-reinforced polyester piping, rods and profiles, including the de Ganahl process developed in the United States. He suggests a new method which dispenses with mandrels for making piping and requires the glass fibers to be circularly woven on a special machine to form a casing of variable diameter. For thicker-wall tubes, two or more of the casings can be fitted one inside the other, as required. The casing passes through a rotating calibrator of variable diameter into the impregnation chamber where parallel rows of coating elements pulverize the resin as they rotate, coating the outside of the casing. At the same time, the casing is coated on the inside by a centrifugal row of coating elements which turn in a direction opposite to that of the external coaters, and are connected to a pressure feed box. The coated tube next passes through a calibrator guide to get its final required diameter before undergoing polymerization. By a modification of this process, solid or hollow rods and profiles also are produced. It is claimed that the method insures an unusually high degree of uniformity as to quality. (In French.)

Application

"Rilsan in Electrotechnics," R. Dumon, *Ind. Plastiques Mod.*, 8, 1, 1 (Jan. 1956).

The French superpolyamide, Rilsan, is made by polymerizing a castor oil product, 11-amino undecanoic acid. It resembles Nylon 6-6 in its basic properties, but has certain special characteristics, the most important being its very low coefficient of water absorption (in the order of 1%). The electrical, mechanical, and chemical properties of the material are discussed, as well as its use for low and medium frequencies and tensions; in insulation parts for radio, telephone, aviation, automobile, etc.; for insulating cables and wires; for insulation tape; and in flame-spraying. (In French.)

"New Packaging Concepts with Cellulose Acetate," D. P. Clarke, *Canadian Plastics*, 96 (June 1956).

The properties that make cellulose acetate so suitable for packaging purposes are listed, and a number of recent applications mentioned, including blister and skin packages, especially for multi-unit packages; fabricated and extruded containers; and window boxes.

"Algoflon (Polytetrafluoroethylene) in the Chemical Industry," F. Montaguti, *Materie Plastiche*, 22, 1, 25 (Jan. 1956).

Algoflon is the P.T.F.E. produced in Italy by the Montecatini concern. Its physical properties and resistance to a number of corrosive and other substances are listed, and its application in various types of packings, fittings, and gaskets for use in chemical apparatus and machines for the chemical industry are described. (In Italian.)

"Plastic Bags—A Survey of the Present Situation and Future Trends," J. Hansen, *Kunststoffe*, 46, 6, 253 (June 1956).

A comprehensive review of the various types of films and combinations of films suitable for bag making; bag shapes and closures; and bag-making and sealing machines. (In German.)

"New Uses for Silicones in France," P. M. Morel, *Ind. Plastiques Mod.*, 8, 1, 14 (Jan. 1956).

Three types of products are discussed: silicone preparations which the housewife can apply herself to hats, gloves, stockings, and umbrellas to make them shed rain; a silicone dope for incorporation in floor and furniture waxes; and polishes to make treated surfaces washable and washable wallpapers. All three permit easy removal of spots and stains. (In French.)

"Properties and Applications of the Usual Types of Plastic Packaging Films," W. Tiebel, *Kunststoffe*, 46, 6, 233 (June 1956).

A brief resume of the methods of producing plastic packaging films precedes a discussion of the properties of the individual types of plastic films in general use. This is accompanied by tables listing properties, available forms, and applications, as well as remarks on processing and appropriate printing methods. (In German.)

"Plastic-Coated Paper," W. Schoch, *Kunststoffe*, 46, 6, 238 (June 1956).

The field of application for paper packaging materials has been expanded considerably by the use of plastics either in the form of film in laminations or as coating dispersions. Their properties in these forms are discussed, and methods of use in semi-automatic and fully automatic packaging processes in the United States, Germany, and Sweden are explained and illustrated by specific examples. (In German.)

"Plastic Closures for Bottles and Tubes," W. Laeis, *Kunststoffe*, 46, 6, 297 (June 1956).

A wide variety of closures and tops for bottles, tubes, sprays, and dispensers for a number of purposes are dealt with. The place of phenolic and urea molding compounds, cellulose acetate, polystyrene, polyamide, PVC, and acrylic resins in these applications is described, with emphasis on polyethylene whose consistency, processing, and service properties are opening entirely new packaging possibilities. (In German.)

"Foamed Plastics as Packaging Material," F. Stastny, *Kunststoffe*, 46, 6, 302 (June 1956).

Because of their special properties, foamed plastics find growing use wherever thermal or shock insulation are required. The materials dealt with in this article are chiefly the German products Iporka, Moltoprene, and Styropor. Reference also is made to Styrofoam; an American phenol-formaldehyde condensation product similar to Iporka; and the Swiss rigid PVC foam, Airex. (In German.)

General

"Properties of Marlex 50 Ethylene Polymer," R. V. Jones and P. J. Boeke, *Ind. Eng. Chem.*, 48, 7, 1155 (July 1956).

Properties of the polymer are discussed and compared with those of conventional high-pressure polyethylenes.

"Irradiation of Plastics," *SPE J.*, 12, 7, 27 (July 1956).

The chemical reaction mechanisms involved as a result of irradiations, and how these reactions can be modified, are discussed. Significant results with plastics obtained to date are summarized.

"The Effects of Explosions on Plastics," H. A. Perry, Jr., *SPE J.*, 12, 7, 13 (July 1956).

Some results are given on the behavior of various plastic materials when subjected to shock waves generated by the detonation of lead azide.

Patent Digest

Materials

Aqueous Dispersion of Vinylidene Chloride Polymers Containing Hydrogen Peroxide as a Corrosion Inhibitor. No. 2,744,080. Gilbert W. Brant, Buffalo, N. Y. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The coating composition consists of an aqueous suspension of vinylidene chloride polymerized in situ with an anionic dispersing agent, and catalytic amounts of ammonium persulfate and meta-sodium bisulfite. To this is added 0.1-1% by weight of hydrogen peroxide.

Compositions Comprising Acrylonitrile Polymers and Tri (beta-cyanoethyl) nitromethane. No. 2,744,081. Eugene L. Ringwald and Alfred B. Craig, Decatur, Ala. (to Chemstrand Corp., Decatur, Ala.).

The composition consists of a homogeneous miscible mixture of tri (beta-cyanoethyl) nitromethane and an acrylonitrile polymer containing up to 99% acrylonitrile.

Dissolution of Acrylonitrile Polymers. No. 2,744,082. James S. Ballentine, Media, Pa. (to Chemstrand Corp., Philadelphia, Pa.).

Clear, substantially gel-free solutions of acrylonitrile are obtained by dipersing the polymer in particulate form by means of a suitable solvent. This dispersion is then subjected to an electrostatic field, maintaining an alternating current of at least 30 megacycles. Sufficient heat is applied to effect partial dissolution of the particles.

Olefin Polymerization Process Using Hydrogenated Naphtha Solvent. No. 2,744,084. William F. Arey, Jr., Baton Rouge, La. (to Esso Research & Engineering Co., New York, N. Y.).

Isobutylene is polymerized with a Friedel-Crafts catalyst at temperatures below 0° C., and in the presence of a hydrogenated petroleum naphtha as a solvent. The latter material should have an initial boiling point of at least 100° F., and an end point below 400° F.

Polyhydroxypolyalkylenepolyureas. No. 2,742,453. Robert W. Auten, Jenkintown, and Robert S. Yost, Oreland, Pa. (to Rohm & Haas Co., Philadelphia, Pa.).

Epichlorhydrin and an alkylene polyamine are reacted in an aqueous medium at a temperature of 0-100° C. until the resulting compound has a viscosity of J-Z_7 on the Gardner-Holdt scale. This material is then reacted with urea at a temperature of 100-200° C. until a 45% aqueous solution of the resulting material has a Gardner-Holdt rating of B-Z_3 at 25° C.

Cellulose Organic Ester Compositions Containing an Oxidation-Resistant Plasticizer. No. 2,743,187. Alan Bell and George C. De Croes, Kingsport, Tenn. (to Eastman Kodak Co., Rochester, N. Y.).

The composition comprises 100 parts by weight of a cellulose ester such as acetate, acetate-propionate, or acetate-butyrate, plus the plasticizer. This latter material consists of 5-50 parts by weight of 2,3-dimethyl-propanediol-1,3 di-p-ter-butylbenzoate.

Oxyalkylated Amine-Modified Thermoplastic Phenol-Aldehyde Resins, and Method of Making Same. No. 2,743,252. Melvin De Groote, University City, Mo. (to Petrolite Corp., Wilmington, Del.).

An oxyalkylation-susceptible, fusible, non-oxygenated phenolaldehyde resin is condensed, and oxyalkylated by means of an alpha-beta alkylene oxide.

Cellulose Acetate-Butyrate Plasticized with a Di-Alkyl Suberate. No. 2,744,026. Charles P. Albus, Easton, Pa., and Donald E. Sargent, Schenectady, N. Y. (to General Aniline & Film Corp., New York, N. Y.).

The plasticizer is an ester chosen from the group consisting of di-n-hexyl suberate and di-n-octyl suberate.

Admixtures of Trifluorochloroethylene Polymers and Method for Molding Same. No. 2,742,446. Eugene F. Schwarzenbeck, Montclair, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

The composition consists of a thermoplastic trifluorochloroethylene polymer having a N.S.T. above 290° C., and another with a N.S.T. at least 20° lower. The ratio is about 90:1.

Styrene-Modified Alkyd Resins from 5-Tertiary Butyl Isophthalic Acid. No. 2,742,445. Funston G. Lum, Richmond, Calif. (to Californla Research Corp., San Francisco, Calif.).

Modified, unsaturated polyester resins are prepared by copolymerization of styrene with a base resin derived from the polymerization of a polyhydric alcohol with an aliphatic alpha, beta ethylenically unsaturated dicarboxylic acid and a benzene dicarboxylic acid.

Epoxy Resin Combinations Containing Titanate. No. 2,742,448. Harry H. Beacham, Plainfield, and Kenneth M. Merz, New Brunswick, N. J. (to National Lead Co., New York, N. Y.).

In this compound, the two side groups are monovalent hydrocarbon radicals and both an alkyl orthotitanate admixed with an amine, and an orthotitanate of a hydroxyamine.

Process for Improving the Hardening Characteristics of Phenolic Resins. No. 2,742,449. Felix Schlenker, Wiesbaden, Germany. (to Chemische Werke Albert, Wiesbaden-Kastel, Germany).

The resin is produced by condensing a phenol with formaldehyde, using a hardening agent which is a salt of a polyvalent metal with a tautomeric-reacting carbonyl compound of the keto-enol structure.

Fillers Having Vinyl Siloxane Groups Bonded to the Surface Thereof and Copolymers Thereof with Ethylenically-Unsaturated Polymerizable Monomers. No. 2,724,378. Theodore A. Te Grotenhuis, Olmstead Falls, O. (to General Tire & Rubber Co., Akron, O).

Fibers and inorganic pulverulent solids, plus a solid polymer which has been polymerized in situ, are contacted with an interfacial layer of vinyl siloxane groups.

Method of Preparing Finely Divided Polyamides. No. 2,742,440. Louis L. Stott, Reading, Pa., and Laurence R. B. Hervey, West Concord, Mass. (to Polymer Corp., Reading, Pa.).

The polyamide is mixed with a solvent, placed in an oxygen-free system, and heated under sub-atmospheric pressure to a temperature above the solvent's boiling point. The mixture is then cooled to precipitate the polyamide, and the solvent removed.

High-Strength, Heat-Resistant Plastic Material. No. 2,742,443. Frederick W. Diggles, Topanga, Calif. (to North American Aviation, Inc., Los Angeles, Calif.).

The material comprises approximately 100 parts by weight of methyl methacrylate, a polymerization catalyst, and 22-25 parts by weight of cellulose acetate butyrate ester. The latter material should consist of about 38% butyrate by weight, and the remainder cellulose acetate.

Preparation of Acrylonitrile. No. 2,744,926. Russell E. Koons, El Dorado, Ark. (to Monsanto Chemical Co., St. Louis, Mo.).

Acetylene and hydrogen cyanide are re-

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.
—The Editor

ted in the presence of a liquid cuprous loride complex as a catalyst. This latter aterial is circulated continuously through e reaction zone, countercurrent to the w of acetylene. Introduction is by means a liquid spray.

Modified Polyvinyl Acetal Resin Compositions. No. 2,746,945. Francis T. uckley, Ludlow, Mass. (to Monsanto hemical Co., St. Louis, Mo.).

The compound consists of a polyvinyl utyraldehyde resin, a plasticizer, 0.1 part f paratertiary amyl phenol per 100 parts f resin, and two parts of triphenyl fluoroilane per 100 parts of resin.

Process for the Production of Polyacrylonitrile. No. 2,745,825. Heinrich Wenning Marl, Westphalia, Germany (to Chemische Werke Hulz Aktiengesellschaft, Germany).

Acrylonitrile is polymerized in aqueous ispersion at a temperature of 25-75° C., nder a sulfur dioxide pressure of 1-5 tmospheres.

Vinyl Resins Stabilized with Organotin Sulfides. No. 2,746,946. Elliott L. Weinberg, Long Island City, N. Y., and Hugh E. Ramsden, Metuchen, N. J. (to Metal & Thermit Corp., New York, N. Y.).

The composition comprises a chlorine-containing vinyl resin and a stabilizing amount of a hydrocarbontin sulfide, the hydrocarbon groups of which being bonded to tin and the sulfur only to tin.

Polymerization of Vinyl Acetate with Peroxide, Amine, Sulfinic Acid Catalyst System. No. 2,746,947. Tsuguo Kominami and Junji Ukita, Toyama-shi, Japan. (to Omni Products Corp., New York, N. Y.).

The process comprises polymerizing vinyl acetate in homogenous liquid phase, and in the presence of a catalyst mixture containing the above-mentioned materials.

Vinyl Halide Resin Stabilized with Basic Lead Carboxylates. No. 2,744,881. John G. Hendricks, Chatham, N. J., and Leonard M. Kebrich, Brooklyn, N. Y. (to National Lead Co., New York, N. Y.).

The composition comprises a vinyl chloride resin and 0.25-10% by weight of a heat and light stabilizer containing basic lead aliphatic dicarboxylates.

Copolymers of a Perfluorochloroethylene and a Fluoroethylene and Method for Their Preparation. No. 2,572,331. Albert L. Dittman, North Bergen, Herbert J. Passino, Englewood, and Wilber O. Teeters, River Edge, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

The copolymer contains 25-50 mole per cent trifluorochloroethylene and 50-75 mole per cent vinylidene fluoride as the sole monomer components.

Process for Preparing Vinyl Halide Copolymers and Copolymers Produced Thereby. No. 2,746,944. Marguerite Naps, Oakland, and Fred E. Condo, El Cerrito, Calif. (to Shell Development Co., San Francisco, Calif.).

Resinous Products from Aromatic Poly-Ketones and Thio Acid Polyamides. No. 2,752,327. Herman S. Bloch, Chicago, and Ralph B. Thompson, Hinsdale, Ill. (to Universal Oil Products Co., Chicago, Ill.).

Resinifying reactants consisting essentially of an aromatic polyketone and a sulfur-containing thio acid are reacted, the carbonyl groups of the polyketone being the only amido-reactive substituents in said polyketone.

Oxycresyl Camphene as a Light Stabilizer for Copolymer of Isobutylene and Styrene. No. 2,752,326. Robert E. Clayton, Jr., Roselle Park, N. J. (to Esso Research & Engineering Co., New York, N. Y.).

The thermoplastic copolymer consists of approximately 40% isobutylene and about 60% styrene; the composition having an intrinsic viscosity of about 0.7, and being substantially free from aliphatic unsaturation. About one part of oxycresyl camphene per 100 parts copolymer is added to prevent light deterioration.

Processing

Process for Producing Cellular Thermoplastic Bodies. No. 2,751,627. Herbert Lindemann, Sins, Switzerland (to Lonza Electric & Chemical Works, Ltd., Gampel, Switzerland).

Gas-expanded thermoplastic bodies with closed-cell structure are formed by heating the thermoplastic mass in a mold, while exposing it to gas under pressure. On removal from the mold, the mass expands since it is filled with gas at higher than atmospheric pressure.

Process of Reshaping Plastic Materials. No. 2,751,629. Franklin Dick, New York, N. Y. (to Richard A. Fisch, Long Island City, N. Y.).

A pellicular body of thermoplastic material, free of volatile solvents and containing 3-50% plasticizer, is fitted about an object of substantially the same size. This is then treated in a leaching bath containing a volatile organic solvent for the plasticizer. On removal and drying, the thermoplastic shrinks to form a layer of increased hardness due to plasticizer loss.

Lubricating Tetrafluoroethylene Polymers. No. 2,752,321. George W. Heller, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The extrudability of particulate polytetrafluoroethylene is improved by admixing particles with 7-45 cc. of a lubricating organic liquid per 100 grams of resin. The lubricating liquid consists essentially of a hydrocarbon oil, which is mixed uniformly throughout the mass by compression.

Removing Polyethylene from Metal Surfaces. No. 2,744,841. Frank Cassis, Munster, Ind., and Charles R. Greene, El Cerrito, Calif. (to Standard Oil Co., Chicago, Ill.).

Pentaerythritol is heated to a temperature above the softening point of the polyethylene, and applied to its surface. Care should be taken not to heat the pentaerythritol above its own melting point.

Production of Porous-Shaped Articles from Thermoplastic Materials. No. 2,744,291. Fritz Stastny, Weinheim an der Bergstrasse, and Karl Buchholz, Ludwigshafen, Germany (to Badische Anilin & Soda Aktiengesellschaft, Ludwigshafen, Germany).

Molds of the desired contour are incompletely filled with a finely-divided thermoplastic material containing a volatile organic liquid homogeneously dispersed throughout the particles. This material is expanded to fill the mold, which has exit points for the gases formed in the processing.

Laminated Glass Fabric. No. 2,743,207. Adolphe Rusch, Rumson, N. J. (to the United States of America as represented by the Secretary of the Army).

Glass fabric is impregnated with polystyrene and placed in a laminating press which has one platen with a roughened surface and the other completely smooth. Laminating resin is applied to the rough surface of the pressed sheet; another layer of fabric is added; another coat of laminating resin is applied; and the laminate is placed in the press. These steps are repeated until the desired number of plies have been obtained.

Method for Bonding Plastic Materials. No. 2,742,390. Ronald D. Beck, Clawson, Mich. (to General Motors Corp., Detroit, Mich.).

Metal attachment clips having a flat surface are attached to a plastic panel in the following manner: the panel surface is roughened and a low temperature-curing thermosetting resin is applied; the clip and a wave-shaped electrical resistance element are pressed into the resin; and the roughened surface of a plastic reinforcing block is pressed into the resin. Electrical current is then applied to effect cure.

Reinforced Plastic Structural Member. No. 2,742,388. Alfred W. Russell, Farmingdale, N. Y. (to Russell Reinforced Plastics Corp., Lindenhurst, N. Y.).

Two layers of resin, reinforced with thermoplastic fibers, are superimposed on either side of a non-adhering strip of material of lesser width. The longitudinal edges are then bonded together leaving a longitudinal pocket between the bonded edges. A forming tool is inserted into the pocket, and the structure is heated to the softening point of the fiber. This imparts a predetermined cross-sectional shape to the pocket, which is retained on cooling.

General Statistics for the Plastics Materials Industry

	1947	1954	% change
Establishments	125	205	64
Employes, thousands	28.6	41.6	45
Payroll, million dollars	91.4	204	123
Production workers, thousands	21.8	28.8	32
Man hours, millions	46.3	58.4	26
Wages, million dollars	63.3	122.8	94
Value of shipments, manufacturers' net:			
Million dollars	197.5	585	196
Gross value, million dollars	478.3	1,242	160
Manufacturers' costs, million dollars	280.8	657	134
Capital expenditures, million dollars	58.4	108.8	86

	Total Shipments[1] During 1954	
	Quantity (1,000 lbs.)	Value ($1,000)
Plastics materials, total		1,459,547
Cellulosics (including fillers, plasticizers, etc.)		82,210
Cellulose acetate and mixed esters:		
Continuous sheets (under 0.003 gage)	15,951	14,526
Continuous sheets (over 0.003 gage)	12,928	12,270
All other sheets	2,927	3,653
Rods and tubes	1,017	213
Molding and extrusion materials	70,358	36,794
Other uses	6,145	2,473
Nitrocellulose sheets	4,462	7,564
Rods, tubes, and other uses	718	1,066
Other cellulosics[2] (including ethyl cellulose)	5,489	3,051
Vinyl and polyethylene unsupported film and sheet (excluding floor and wall coverings)		169,350
Under 3 mils	26,955	22,175
3–3.9 mils	35,835	19,122
4–5.9 mils	43,013	21,462
6–9.9 mils	15,937	9,357
10–14.9 mils	48,055	27,378
15–19.9 mils	33,339	16,367
20 mils and over	20,475	15,327
Polyethylene sheeting and film, under 3 mils	47,346	32,062
3–5.9 mils	7,582	4,913
6–14.9 mils	1,097	741
Over 15 mils	257	289
Unspecified vinyl and polyethylene film and sheet		157
Synthetic resins		766,294
Phenolic and other tar acid resins, dry basis:		
Casting	5,689	3,151
Laminating	71,821	18,933
Adhesive	67,204	14,904
Molding materials	183,482	38,073
Other uses	71,052	18,850
Urea and melamines, dry basis:		
Adhesive	94,430	16,808
Textile and paper-treating resins	61,718	12,206
Molding materials and other uses	103,562	36,534
Vinyl resins:		
Sheeting	121,663	47,806
Textile and paper coating	18,832	8,248
Adhesive	28,869	11,515
Molding and extrusion material	151,663	56,924
Other uses (including safety glass sheeting)	197,836	96,979
Polystyrene resins, molding materials	318,673	102,360
Polyethylene, excluding sheeting & film, protective coatings, and monofilaments	84,217	35,158
Other synthetic resins, excluding rubbers and protective coatings		247,845
Plastics and resin materials, not classified		211,973
Casein plastics, for adhesives and other uses	21,393	5,354
Protective coatings (alkyd and others)		156,376
All other plastics, excluding photographic film, rayon, or nitro explosives		50,243
Plastic materials, not specified by kind		703

[1] Including interplant transfers.
[2] Excludes varnish, lacquer, dope, and regenerated cellulosics
[3] Excludes protective coatings.

SOURCE: U. S. Department of Commerce, Bureau of Census.

Domestic Production and Sales of Plastics and Resin Material, May and June, 1956

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of May and June, 1956. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Over-all production and sales showed a drop of almost 20-million pounds; sharpest declines being in the categories of styrene and vinyls. Sales of cellulosics and polyethylene, however, showed slight gains.

	May		June	
Cellulose Plastics:[2]	Production	Sales	Production	Sales
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,465,760	1,529,991	1,972,943	2,027,736
Sheets, 0.003 gage and over	1,345,982	1,347,293	1,412,532	1,319,926
All other sheets, rods, and tubes	668,924	613,164	869,528	640,970
Molding and extrusion materials	7,457,817	7,299,385	7,799,385	7,779,138
Nitrocellulose sheets, rods, and tubes	568,623	412,757	486,846	390,610
Other cellulose plastics	489,098	503,727	407,017	388,882
TOTAL	11,996,204	11,700,171	12,748,251	12,547,262
Phenolic and Other Tar-Acid Resins:				
Molding materials[3]	20,521,650	17,680,699	18,990,775	17,830,081
Bonding and adhesive resins for—				
Laminating (except plywood)	5,403,363	3,311,869	5,092,604	3,547,247
Coated and bonded abrasives	1,304,357	1,251,678	1,186,380	1,512,018
Friction materials (brake linings, clutch facings, and similar materials)	1,283,489	1,003,110	1,360,295	1,169,687
Thermal insulation (fiber glass, rock wool)	4,461,057	5,299,705	4,984,669	5,451,923
Plywood	3,424,737	2,685,992	3,268,992	2,949,680
All other bonding and adhesive uses	2,759,433	2,703,466	2,664,057	2,601,625
Protective-coating resins, unmodified and modified except by rosin	2,576,311	2,013,742	2,155,247	2,448,429
Resins for all other uses	2,587,946	2,377,972	2,507,096	2,181,760
TOTAL	44,322,363	38,328,233	42,209,564	39,692,450
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,404,936	3,256,302	2,683,849	2,518,215
Paper-treating and paper-coating resins	2,177,360	2,315,576	2,216,070	1,771,478
Bonding and adhesive resins for—				
Plywood	8,276,698	7,598,178	10,034,559	8,709,462
All other bonding and adhesive uses, including laminating	1,954,232	2,153,825	2,168,960	1,780,696
Protective-coating resins, straight and modified	3,116,154	2,184,278	2,424,180	1,696,881
Resins for all other uses, including molding	7,642,109	7,480,905	7,727,059	6,023,946
TOTAL	26,571,489	24,989,064	27,254,677	22,500,678
Styrene Resins:				
Molding materials[3]	41,186,790	37,899,095	36,090,195	28,966,709
Protective-coating resins, straight and modified	8,026,653	8,447,944	8,065,918	6,803,567
Resins for all other uses	9,293,547	8,189,503	7,932,804	7,298,318
TOTAL	58,506,990	54,536,542	52,088,917	41,068,594
Vinyl and Vinyl Chloride Resins:[3]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		5,948,168		5,344,569
Sheeting (resin content)		4,403,274		4,217,449
Molding and extrusion (resin content)		16,469,944		14,945,741
Textile and paper treating and coating (resin content)[1]		4,321,583		4,726,952
Flooring (resin content)		5,074,998		5,315,741
Protective coatings (resin content)		2,454,334		2,363,637
All other uses (resin content)		6,087,030		5,227,774
All other vinyl resins for—				
Adhesives (resin content)		3,287,569		2,863,256
All other uses (resin content)		10,157,634		7,730,785
TOTAL	63,977,448	58,204,534	54,832,768	52,735,904
Coumarone-Indene and Petroleum Polymer Resins	20,966,161	20,237,699	19,465,159	19,031,281
Polyester Resins	7,288,892	6,886,731	6,403,653	5,724,781
Polyethylene Resins	47,010,129	41,801,669	45,633,928	44,137,147
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1,4]	3,709,715	3,100,052	3,511,591	2,795,909
Protective-coating resins[5]	1,142,783	502,393	980,511	456,409
Resins for all other uses[6]	10,802,776	9,530,533	9,639,961	8,656,670
TOTAL	15,655,274	13,132,978	14,143,063	11,908,988
GRAND TOTALS	296,294,950	269,817,621	274,768,980	249,347,085

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
SOURCE: United States Tariff Commission, Chemical Division.

CALENDAR of COMING EVENTS

October 22-26
National Industrial Exposition & Management Conference. Detroit Artillery Armory, Detroit, Mich.

October 23
SPE Philadelphia Section. Franklin Institute, Philadelphia, Pa.

October 24
SPE Quebec Section. Queens Hotel, Montreal, P. Q., Canada.

October 25
SPE Rhode Island and Southeastern Massachusetts Section. Crown Hotel, Providence, R. I.

October 31
Reinforced Plastics Group, SPE New York Section. Tufaro's Restaurant, Corona (Queens), N. Y.

November 7
SPE Western New England Section. Bradley Field, Windsor Locks, Conn.

November 7-9
Society of Rheology, Annual Meeting. Mellon Institute and Webster Hall, Pittsburgh, Pa.

November 12
SPE Cleveland-Akron Section. Spanish Tavern, Brecksville, O.

November 14
SPE Newark Section. Military Park Hotel, Newark, N. J.

November 16
SPE Southern California Section, One-day Symposium on Epoxy Resins. Institute of Aeronautical Sciences, Los Angeles, Calif.

November 19
SPE Southern Section. Mammy's Shanty, Atlanta, Ga.

November 21
SPE New York Section. Gotham Hotel, New York City.

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Current Market Prices

This listing is as comprehensive and up-to-date as possible. The full listing will appear quarterly, while intervening issues will carry a briefer tabulation of price changes and additions.

Companies whose products do not appear are invited to submit price data for inclusion in the listing. All suppliers are requested to submit product additions and price changes promptly as they occur, in order to make this listing of maximum value to our readers.

Prices, in general, are f.o.b. works. Ranges indicate quantity or grade variations. No guarantee of these prices is made, and spot prices should be obtained from the individual suppliers.

— The Editor

Adhesives

Ampcoflex Adhesive	gl.	$2.75 /	$3.50
Bakelite BC—17613	lb.	.54 /	.84
BCU-40	lb.	.18 /	.48
BR-11938	lb.	.285 /	.585
Bonding resins, abrasives	lb.	.20 /	.915
Brake linings	lb.	.215 /	.6275
Foundry resins	lb.	.2075 /	.395
Heat Insul. resins	lb.	.1425/	.37
CD Cement Nos. 200, 201, 202, 203, 204	gl.	.94 /	1.50
PS-7	gl.	2.12 /	2.90
Epon Adhesive VI, VIII	lb.	3.08 /	3.30
IX	lb.	4.25 /	4.50
Epoxy Adhesive A-1, A-3, A-4	gl.	4.45 /	6.90
A-2, A-5	gl.	5.60 /	8.00
A-6	gl.	5.80 /	8.00
C-1, C-2, C-3, C-9	gl.	5.60 /	8.00
C-4, C-7	gl.	3.69 /	5.30
Flexible Resin No. 1	gl.	4.45 /	6.90
G-E 12316	lb.	.30 /	.39
12353	lb.	.225 /	.385
Melmac 401	lb.	.45	
421	lb.	.45 /	.47
Melurac 300, 302	lb.	.25 /	.29
301	lb.	.28 /	.33
Metlbond 2002-14	gl.	1.84 /	5.00
4021 Type I	sq. ft.	1.43	
Type II	gl.	1.29 /	3.20
Type III	gl.	1.49 /	3.50
Plaskon Phenolic Bonding Resin	lb.	.16 /	.21
Urea Adhesive 530-11L	lb.	.1875/	.2175
Liquid Adhesive, 2L Types	lb.	.105 /	.115
WR Types	lb.	.0675/	.125
Spray Dried Adhesives	lb.	.18 /	.29
Plastic Cement	gal.	2.25 /	2.70
Pliobond 20	gal.	4.50 /	7.00
30	gal.	5.25 /	8.00
Polyester Foam Cement PC-232	gal.	2.40 /	2.90
Schenectady SP-7401	lb.	.29 /	.31
Schwartz Vinyl Cement	gl.	1.24 /	1.50
Synvarite US #1	lb.	.195 /	.215
Synvarol T	lb.	.125 /	.16
T-3	lb.	.0875/	.1225
T-15, T-15D	lb.	.1275/	.1625
TN, TUN	lb.	.1325/	.1675
TN-23	lb.	.14 /	.175
WR-513	lb.	.0875/	.1225
WR-515	lb.	.0825/	.1175
WR-520	lb.	.0625/	.0925
Styrofoam Adhesive #5	gal.	3.75 /	4.75
Thixon CB	gal.	3.30 /	3.70
CB-2	gal.	3.75 /	3.95
IB	gal.	3.75 /	4.15
NB	gal.	4.05 /	4.45
NM-2	gal.	7.20 /	8.00
Urac 110	lb.	.205 /	.225
115	lb.	.24 /	.26
180	lb.	.095 /	.12
185	lb.	.1625/	.2175
186	lb.	.0875/	.1125
192	lb.	.07	

Anti-Static Agents

Anstac-2M	gl.	1.75 /	2.00
Logostat	gal.	1.35 /	1.65
Merix Anti-Static #79	gl.	.75 /	3.85
#79-OL	gl.	.75 /	3.85

Catalysts

Advasol	lb.	.4375/	.5375
Aritemp Curing Agent 105	lb.	2.00 /	2.25
Bakelite BH-17618	lb.	.33 /	.63
BHU-53	lb.	.15 /	.45
ERL series	lb.	.67 /	1.195
Cadet benzoyl peroxide, granules	lb.	.98 /	2.00
Paste	lb.	.95 /	2.25
Powder	lb.	1.50 /	2.37
Dichlorobenzoyl peroxide	lb.	$3.00 /	$4.25
Lauroyl peroxide	lb.	1.90 /	3.50
Methyl ethyl ketone peroxide	lb.	1.85 /	4.00
Catalyst 57	lb.	.12	
196	lb.	.10	
C-110, -180, -180-S, C-110-S, WF-100, -101	lb.	.12	
Celanese accelerators D & E	lb.	.43 /	.50
Benzol peroxide paste	lb.	2.00	
Catalyst MC-1	lb.	2.25 /	2.50
Epon Curing Agent BF_3-400	lb.	4.00 /	4.50
C-111	lb.	.6225/	1.10
D	lb.	3.33 /	4.75
T	lb.	.80 /	1.11
U	lb.	.86 /	1.02
Z	lb.	1.265 /	1.56
Furane H-736-A	lb.	1.30 /	2.00
Marblette Hardener 11	lb.	1.17 /	1.65
16, 661, 680	lb.	1.25 /	1.70
20	lb.	1.17 /	1.40
21	lb.	1.27 /	1.40
41, 665	lb.	1.32 /	1.77
175, 179	lb.	.50 /	.65
645H	lb.	1.15 /	1.70
681, 901	lb.	1.20 /	1.80
900, 903	lb.	2.10 /	2.50
H C Promoter 6%	lb.	.5275/	.6275
12%	lb.	.9025/	1.0025
Het anhydride	lb.	.55	
HN 551	lb.	.95 /	1.40
901	lb.	.36 /	.80
951 Ciba	lb.	.82 /	1.32
951 Furane	lb.	1.30 /	2.00
IC activators		3.00	
Inhibitor	lb.	.98	
Melurac 255, 259	lb.	.35	
Modifier CB-110, WF-61	lb.	.15	
P-27	gal.	10.00	
Plaskon Hardeners, Liquid	lb.	.07	
Powdered	lb.	.10 /	.46
Spray dried	lb.	.10 /	.25
Promoter D-2	lb.	1.60 /	2.00
Quick-Set Accelerator 804	gal.	9.80	
Rezolin epoxy hardeners	lb.	1.14 /	2.50
SA Hardener	lb.	.10	
Soligen	lb.	.4825/	.5825

Coating Resins

Acryloids	lb.	.30 /	.87
Amberlacs	lb.	.2625/	.2875
Amberols, phenolic types	lb.	.2125/	.375
Rosin maleic types	lb.	.21 /	.345
Bakelite Phenolics	lb.	.28 /	.64
Styrene emulsions	lb.	.1375/	.31
Vinyl acetates	lb.	.295 /	.66
Solutions	gal.	5.10	
Alcohols	gal.	2.27 /	2.76
Butyral resins	lb.	1.04 /	1.24
Chlorides	lb.	.41 /	.61
Chloride-acetates	lb.	.38 /	.66
Modified	lb.	.44 /	.72
Celanese PVA emulsions, homopolymers	lb.	.17 /	.26
Copolymers	lb.	.19 /	.28
Chemigum latices	lb.	.46 /	.60
Cymel 243-3	lb.	.38 /	.385
245-8	lb.	.34 /	.345
247-10	lb.	.385 /	.39
248-8	lb.	.365 /	.37
Dylex K-500, -600, -700, -900	lb.	.30 /	.46
G-E 13110	lb.	.30 /	.39
G.M.I. Polyamids 100	lb.	.51 /	.64
115	lb.	.54 /	.77
Kel-F Dispersion (dry wt.)	lb.	12.00	
Ladcote FHHF-4010, FYHF-4010	lb.	.3575/	.4075
Plaskon Alkyds	lb.	.1075/	.3375
Modified	lb.	.15 /	.2625
Ester Gums	lb.	.1425/	.2475
Maleics	lb.	.1825/	.275
Melamines	lb.	.195 /	.435
Phenolics	lb.	.3925/	.475
Modified	lb.	.1825/	.29
Phenolic Laminating Varnishes	lb.	.165 /	.27
Silicone Alkyds	lb.	$1.10 /	$2.40
Ureas	lb.	.195 /	.435
Pliolite latices	lb.	.30 /	.39
Pliolite N R	lb.	.93 /	1.22
S-3	lb.	.42 /	.44
S-5	lb.	.49 /	.51
Milled	lb.	.54 /	.56
S-7	lb.	.88 /	1.01
Polyfluoron liquid dispersions	lb.	2.65 /	3.85
Paste dispersions	lb.	4.20 /	4.40
Primer 140	qt.	7.88 /	8.25
Schenectady Alkyds SA Type	lb.	.3575/	.38
SE Type	lb.	.3675/	1.435
SEA Type	lb.	.3575/	.38
Styrenated	lb.	.22 /	.2625
Maleics	lb.	.1725/	.23
Phenolics	lb.	.2325/	.53
Modified	lb.	.1825/	.275
Schwartz AT-25	qt.	.63 /	1.00
BK-40	gal.	3.80 /	3.95
Synvaren 631	lb.	.18 /	.215
PLS-1	lb.	.455 /	.49
PLS-2	lb.	.42 /	.455
PLS-22	lb.	.415 /	.45
PLSA	lb.	.57 /	.605
PLSAA	lb.	.745 /	.78
PLSR	lb.	.775 /	.81
Synvarite BRLD	lb.	.40 /	.46
Versamid 100	lb.	.51 /	.69
115	lb.	.64 /	.82

Colors

Acheson 0100 Series Paste Dispersions:			
Blacks	lb.	.50 /	.81
Blues	lb.	.55 /	2.175
Green	lb.	2.51 /	2.69
Orange	lb.	.67 /	.85
Reds	lb.	1.08 /	1.34
White	lb.	.52 /	.70
Yellows	lb.	.57 /	.75
Advabrite M-10	lb.	2.25 /	2.40
Advance Brightener M.D.A.C.	lb.	12.00 /	15.00
Akron Chemical Colors:			
Dry blends, reds	lb.	1.08 /	1.23
Yellows	lb.	.58 /	.88
Organic colors, blues	lb.	.75 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	1.10 /	4.40
Yellows	lb.	2.00 /	5.00
Pastes, blues	lb.	1.25 /	1.58
Greens	lb.	1.85 /	1.90
Reds	lb.	1.10 /	1.40
White	lb.	.55 /	.60
Yellows	lb.	1.70 /	1.75
Aquablak No. 1	lb.	.1925/	.1975
B	lb.	.0975/	.1025
G, K	lb.	.12 /	.125
H	lb.	.20 /	.205
L	lb.	.14 /	.145
M	lb.	.105 /	.11
S	lb.	.1175/	.1225
U	lb.	.225 /	.23
X	lb.	.11 /	.115
Cabot carbon blacks:			
Black pearls 2	lb.	.70 /	.78
71	lb.	.32 /	.40
74	lb.	.24 /	.32
81	lb.	.084 /	.135
0	lb.	.12 /	.19
Carbolac 2	lb.	.70 /	.79
Elf 0	lb.	.12 /	.19
Elftex 3, 5, 8	lb.	.085 /	.135
Monarch 71	lb.	.32 /	.40
74	lb.	.24 /	.32
81	lb.	.095 /	.16
Sterling R	lb.	.0525/	0925
S	lb.	.045 /	.0875
Supercarbovar	lb.	.47 /	.54
Cadmolith Reds	lb.	1.72 /	2.20
Yellows	lb.	1.12 /	1.20
California Ink, P. C. color dispersions:			
Black	lb.	.76 /	.77
Blues	lb.	.90 /	2.17
Brown	lb.	.56 /	.57
Green	lb.	2.05 /	2.06
Reds	lb.	.61 /	2.67
White	lb.	.72 /	.73
Yellows	lb.	.62 /	.74
P. C. plasticized boat colors:			
Black	lb.	.76 /	.77
Blue	lb.	1.32 /	1.33
Blue-green	lb.	1.21 /	1.22
Green	lb.	2.12 /	2.13
Red	lb.	2.69 /	2.70
Yellow	lb.	1.71 /	1.71
Claremont 4000-series Pastes			
Blacks	lb.	.82 /	1.01
Blue	lb.	.80	
Browns	lb.	.65 /	2.30
Greens	lb.	.80 /	2.15
Orange	lb.	1.58	
Red	lb.	4.15 /	4.80
Silver	lb.	1.02	
White	lb.	.695	
Yellows	lb.	.65 /	2.87
D-Series pastes,			
Blacks	lb.	.48 /	.64
Blues	lb.	.62 /	1.57
Browns	lb.	.48 /	1.67
Golds	lb.	2.31 /	2.49

Green	lb.	$1.78 /	1.88
Oranges	lb.	.71 /	4.27
Reds	lb.	1.10 /	6.36
Silver	lb.	.89 /	.91
Whites	lb.	.47 /	.60
Yellows	lb.	.56 /	3.70
K-Series pastes,			
Blacks	lb.	.56 /	.71
Blues	lb.	.89 /	1.40
Browns	lb.	.53 /	.55
Greens	lb.	.92 /	1.41
Metallics	lb.	.89 /	2.47
Orange	lb.	.86 /	4.45
Reds	lb.	.99 /	6.85
Violets	lb.	2.28 /	2.30
Whites	lb.	.59 /	.60
Yellows	lb.	.72 /	3.02
Mylar printing inks:			
Aluminum	lb.	.99	
Black	lb.	.81	
Blue	lb.	1.18	
Bronze reducing clear	lb.	.51	
Gold concentrate	lb.	1.07	
Green	lb.	1.27	
Hi-viscosity clear	lb.	.69	
Orange	lb.	.97	
Pearlescent concentrate	lb.	1.98	
Red	lb.	1.19	
Reducing clear	lb.	.68	
White	lb.	.53	
Yellows	lb.	.83 /	1.21
PE-Series, granular concentrates:			
Blacks	lb.	.85 /	1.15
Blues	lb.	2.98 /	3.08
Copper	lb.	1.64 /	1.74
Gold	lb.	1.66 /	1.76
Permanent	lb.	5.10 /	5.20
Green	lb.	3.00 /	3.10
Oranges	lb.	1.12 /	2.85
Pink	lb.	3.25 /	3.35
Reds	lb.	1.93 /	5.35
Silver	lb.	1.27	
Whites	lb.	.70 /	.95
Yellows	lb.	.78 /	3.05
PX-Series pastes:			
Black	lb.	1.58 /	1.68
Blue	lb.	2.50 /	2.60
Browns	lb.	1.08 /	1.47
Green	lb.	2.76 /	2.86
Grey	lb.	1.30 /	1.40
Ochre	lb.	1.27 /	1.37
Orange	lb.	1.48 /	1.58
Silver	lb.	1.45 /	1.55
White	lb.	.91 /	1.01
Yellows	lb.	1.58 /	2.55
RP-Series inks:			
Aluminum	lb.	.89	
Black	lb.	.58	
Blue	lb.	1.08	
Gold	lb.	.95	
Green	lb.	1.12	
Orange	lb.	.83	
Pearlescent	lb.	1.87	
Red	lb.	1.08	
Reducing clears	lb.	.47 /	.65
White	lb.	.49 /	
Yellows	lb.	.71 /	1.09
UR-Series pastes:			
Black	lb.	1.00	
Blue	lb.	1.82	
Brown	lb.	2.00	
Green	lb.	2.20	
Orange	lb.	1.68	
Reds	lb.	1.92 /	3.55
White	lb.	.83	
Yellows	lb.	1.75 /	2.15
Coloidex No. 3	lb.	.24	
Columbian Carbon bone blacks:			
Ivo No. 1	lb.	.1975/	.2075
3	lb.	.1875/	.1975
4	lb.	.16 /	.17
100	lb.	.2075/	.2175
359	lb.	.2025/	.2125
457	lb.	.1925/	.2025
Carbon blacks:			
#140, #140 densed, Paris II, Raven 11, 15	lb.	9.75 /	10.75
Molacco, Statex Beads	lb.	5.75 /	6.75
Molacco Beads	lb.	5.25 /	6.25
Paris Beads, Raven Beads	lb.	8.65 /	9.65
Raven 15 Beads, Statex R Beads	lb.	7.25 /	8.25
Statex, Statex B-12 Beads	lb.	6.75 /	7.75
Statex B-12, B-12A, F-12	lb.	7.75 /	8.75
Statex B densed	lb.	7.50 /	8.50
Colloidal dispersions:			
Coacetateblak CQ-21	lb.	.875 /	.90
CoblacDD Sol, Industrial	lb.	.70 /	.725
Coethloblak CK	lb	1.00 /	1.025
Coresinblak No.3	lb.	.76 /	.785
Costyreneblak CJ-21	lb.	.5425/	.5675
Covarnishblak AR	lb.	.60 /	.625
BJ	lb.	.50 /	.525
BK	lb.	.53 /	.555
Covinylblak BA	lb.	.95 /	.975
BD	lb.	.97 /	.995
BF	lb.	.70 /	.725
BH	lb.	.66 /	.685
BL	lb.	.82 /	.845
BM	lb.	.77 /	.795
CA-18	lb.	1.0725/	1.0975
Cowaxblak BV-25	lb.	.515 /	.54
CB-18	lb.	.5875/	.6125
CM-83	lb.	.485 /	.51
Cyanamid Inorganic pigments:			
Cobalt blues	lb.	$0.28 /	.35
Chrome greens,			
Lexington	lb.	.40 /	.42
Norwood	lb.	.40 /	.45
Willow	lb.	.40 /	.42
Oranges	lb.	.335	
Yellows	lb.	.335	
Iron blues	lb.	.52 /	.57
Molybdate chrome oranges	lb.	.465	
Ultramarine blues	lb.	.19 /	.325
Powders, Unitane-O	lb.	.245 /	.26
Unitane-OR	lb.	.265 /	.28
Organic dyes, Indulines	lb.	.89 /	1.07
Nigrosines	lb.	.65 /	.94
Oil-soluble black	lb.	.68	
Blue	lb.	8.02	
Orange	lb.	1.06	
Reds	lb.	1.49 /	2.28
Yellows	lb.	1.21 /	4.16
Spirit-soluble black	lb.	2.95	
Brown	lb.	5.30	
Orange	lb.	5.87	
Red	lb.	6.41	
Yellows	lb.	4.62 /	4.94
Pigments, alkali blues	lb.	2.10	
Benzidine oranges	lb.	3.00	
Yellows	lb.	.62 /	2.35
Bon reds	lb.	1.50 /	2.00
Carteret red	lb.	.88	
Chlorinated para reds	lb.	1.25	
Clarion orange	lb.	1.65	
Red	lb.	1.25	
Dinitraniline oranges	lb.	1.45	
Fugitive peacock-blue lakes	lb.	.85 /	1.05
Hansa yellows	lb.	2.10	
Lithol reds	lb.	.88 /	.93
Methyl violet toner	lb.	1.25	
Naphthol reds	lb.	.80 /	3.60
Orange lakes	lb.	.75 /	.80
PTMA blue	lb.	5.35	
Greens, Lincoln	lb.	5.10 /	6.40
Violet	lb.	4.15	
Para reds	lb.	1.10	
Phloxine toner	lb.	1.65	
Phthalocyanine blues	lb.	.90 /	4.20
Greens	lb.	3.50 /	3.95
Pigment green	lb.	1.35	
Scarlet	lb.	1.65	
Red Lake C's	lb.	1.13	
Madder	lb.	2.75	
Rhodamines	lb.	6.40	
Toluidine reds	lb.	1.62	
Yellow lakes	lb.	.95 /	1.05
DC Globak	lb.	.77 /	.795
DCY Coblac	lb.	.83 /	.855
Eagle-Picher Basic carbonate White lead	lb.	.19 /	.20
Basic silicate, white lead 201	lb.	.2075/	.2175
202	lb.	.20 /	.21
Litharge	lb.	.19	
Sublimed	lb.	.1910	
Ferro inorganic colors:			
Black	lb.	1.25 /	1.40
Blues	lb.	1.91 /	2.96
Blue-greens	lb.	1.85 /	2.85
Browns	lb.	.90 /	1.31
Oranges	lb.	2.29 /	4.20
Pink	lb.	1.77 /	1.92
Reds	lb.	2.96 /	4.75
Violets	lb.	1.89 /	2.37
Yellows	lb.	1.26 /	2.90
Harwick Stan-Tones, blues, cadmium dry	lb.	1.95 /	2.15
Dry	lb.	.90 /	5.00
GPE	lb.	1.90 /	2.57
MBS	lb.	1.55 /	4.62
PC	lb.	1.80 /	1.92
Brown, GPE	lb.	3.00	
Greens, dry	lb.	.82 /	3.95
GPE	lb.	3.00 /	4.57
MBS	lb.	1.55 /	3.42
PC	lb.	2.20 /	2.25
Pastes	lb.	1.55 /	1.70
Maroon, dry	lb.	5.50	
Oranges, cadmium dry	lb.	2.23 /	5.05
Paste	lb.	2.65 /	3.65
GPE	lb.	1.20 /	4.42
MBS	lb.	2.75 /	2.82
PC	lb.	.75 /	3.25
Reds, cadmium dry	lb.	2.49 /	6.15
Paste	lb.	3.35 /	3.95
Dry	lb.	.85 /	4.60
GPE	lb.	1.65 /	3.00
MBS	lb.	1.00 /	3.60
PC	lb.	1.10 /	3.57
Yellows, cadmium dry	lb.	2.80 /	3.18
Paste		1.63 /	2.19
Dry	lb.	.62 /	2.35
GPE	lb.	2.00 /	4.57
MBS	lb.	1.30 /	2.27
PC	lb.	1.65 /	3.57
Hiblak AE	lb.	.095 /	.10
Interchemical IC Series			
Black	lb.	.56	
Blues	lb.	.75 /	2.10
Browns	lb.	.64 /	.69
Greens	lb.	.90 /	.99
Oranges	lb.	.78 /	.89
Reds	lb.	1.16 /	2.50
White	lb.	.70	
Yellows	lb.	.95 /	1.65
Kentucky inorganics, orange	lb.	.44 /	.64
Yellows	lb.	.31 /	.66
Organics, blues	lb.	$3.00 /	4.15
Greens	lb.	3.50 /	4.60
Purple	lb.	1.85 /	2.05
Reds	lb.	1.95 /	3.85
Kriegr-O-Dip W Types	qt.	2.63 /	7.80
A Types	qt.	1.52 /	2.25
Laminac color pastes	lb.	.76 /	1.90
Mapico colors, black	lb.	.1425/	.145
Browns	lb.	.1525/	.155
Reds	lb.	.1375/	.14
Tans	lb.	.2275/	.23
Yellows	lb.	.115 /	.1225
Mearlmaid Pearls	lb.	14.00 /	25.00
Nacromer Pearls, Series C	lb.	2.15 /	2.25
Series W	lb.	1.50 /	1.60
Pearl Essence, nat	lb.	15.00 /	30.00
Synthetic #100	lb.	1.95	
#300	lb.	1.45	
#600, #900	lb.	2.15 /	2.45
Plastics Color Co., GP colors:			
Blacks	lb.	.75 /	3.80
Blues	lb.	.445 /	.48
Brown	lb.	1.20 /	2.25
Greens	lb.	.65 /	3.50
Reds	lb.	.65 /	3.50
Whites	lb.	.75 /	1.10
Yellows	lb.	1.15 /	1.95
Polyester pastes, aqua	lb.	1.65	
Beige	lb.	1.45	
Black	lb.	1.10	
Blues	lb.	1.20 /	1.30
Brown	lb.	1.35	
Greens	lb.	1.20 /	1.70
Grey	lb.	1.30	
Ivory	lb.	1.30	
Oranges	lb.	1.80 /	2.05
Red	lb.	2.35	
White	lb.	.80	
Yellow	lb.	1.60	
Pliolite S-5 bases with pigment			
Blacks	lb.	.44 /	.49
Blues	lb.	.62 /	1.48
Greens	lb.	.54 /	.58
Oranges	lb	.61 /	.63
Reds	lb.	.31 /	1.20
Whites	lb.	.42 /	.44
Yellows	lb.	.43 /	.45
PMS polyester colors	lb.	.85 /	2.85
Polystyrene colors	lb.	.65 /	4.30
Polysupra polyethylene blues	lb.	.65 /	5.60
Blacks	lb.	.50 /	.80
Browns	lb.	1.48 /	3.30
Greens	lb.	1.82 /	3.55
Ivory	lb.	.65 /	1.00
Purples	lb.	2.10 /	3.30
Reds	lb.	.70 /	6.30
Silver	lb.	1.50 /	2.95
White	lb.	.60 /	.85
Yellow	lb.	1.45 /	4.25
Polystyrene blues	lb.	.50 /	9.20
Blacks	lb.	.50 /	5.30
Browns	lb.	.95 /	2.55
Greens	lb.	.35 /	7.40
Ivory	lb.	.85 /	1.20
Reds	lb.	.35 /	6.40
White	lb.	.60 /	1.05
Yellows	lb.	1.45 /	2.95
R-B-H Plastic Powders:			
Blacks	lb.	.71 /	.79
Blues, iron	lb.	.875	
Phthalocyanines	lb.	2.73	
Browns	lb.	.61 /	.87
Greens, chrome	lb.	.855	
Phthalocyanines	lb.	2.34	
Orange	lb.	.87	
Purple	lb.	3.00	
Red	lb.	1.93	
Whites	lb.	.71 /	.74
Yellow	lb.	.81	
Resin Plasticizer Pastes:			
Blacks	lb.	.505 /	.65
Blue	lb.	1.59	
Green	lb.	1.58	
Orange	lb.	.665	
Reds	lb.	1.15 /	2.24
White	lb.	.50	
Yellows, cadmium	lb.	1.20	
Chrome	lb.	.545	
Vinyl Extrusion Chips:			
Blacks	lb.	.975 /	1.04
Blues, iron	lb.	.90 /	1.08
Phthalocyanine	lb.	2.50	
Brown	lb.	.86	
Green, chrome	lb.	.96	
Phthalocyanine	lb.	2.51	
Oranges	lb.	.875 /	.92
Purple	lb.	3.41	
Reds	lb.	1.38 /	2.02
White	lb.	.78	
Yellow	lb.	.845	
R-C blacks	lb.	5.50 /	21.30
Browns	lb.	4.375 /	15.75
Reds	lb.	.28 /	15.05
Yellows	lb.	3.60 /	14.05
Rez-N-Dye (dry wt.)	lb.	7.50	
Saran colors	lb.	.59 /	1.80
Sherwin-Williams Dispersed Colors	lb.	.55 /	1.97
Inorganic colors, oranges, yellows	lb.	.32 /	.45
Organic colors, blues	lb.	.90 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	.85 /	4.40
Yellows	lb.	.55 /	1.97
Vansul Organic Drys			
Blues	lb.	3.45 /	3.60
Greens	lb.	1.35 /	3.95

Oranges	lb.	$2.21 /	3.00
Reds	lb.	.90 /	4.40
Yellows	lb.	2.00 /	2.25
VAP Dry Dispersions			
Black	lb.	1.00	
Blues	lb.	2.90 /	3.60
Greens	lb.	3.20 /	4.05
Oranges	lb.	1.45 /	2.55
Reds	lb.	1.70 /	4.45
Yellows	lb.	1.35 /	2.55
VP-Series Pastes			
Black	lb.	.70	
Blue	lb.	1.65	
Brown	lb.	1.55	
Green	lb.	2.05	
Oranges	lb.	.80 /	2.30
Reds	lb.	1.15 /	2.55
White	lb.	.47 /	.65
Yellows	lb.	.60 /	1.65
VPE-Series Pastes			
Black	lb.	.90	
Blue	lb.	1.85	
Green	lb.	2.10	
Orange	lb.	1.00	
Reds	lb.	1.45 /	2.30
White	lb.	.90	
Yellows	lb.	1.60 /	2.00
VY Chips			
Blacks	lb.	.90 /	1.30
Blues	lb.	1.00 /	2.25
Brown	lb.	1.60	
Greens	lb.	.90 /	2.45
Oranges	lb.	1.00 /	2.15
Reds	lb.	1.40 /	2.70
White	lb.	.65	
Yellows	lb.	.85 /	1.80
Vinylized colors, blacks, whites	lb.	.755	
Blues	lb.	1.16 /	1.18
Golds	lb.	1.51 /	1.57
Green	lb.	1.45	
Metallic	lb.	1.15	
Orange	lb.	.83	
Reds	lb.	1.15 /	2.27
Yellows	lb.	.76 /	1.09
Violite 199, green	lb.	2.95	
200, yellow	lb.	3.75	
PL 3-60, blue	lb.	3.25	
18-70, blue	lb.	3.70	
Williams colors & pigments:			
Blacks, iron oxide	lb.	.1425/	.145
Browns, iron oxide	lb.	.1525/	.155
Burnt umbers	lb.	.0775/	.095
Greens, chromium oxide	lb.	.42 /	.4875
Reds, 100 series, 1,000 series, RY series	lb.	.1375/	.14
Kromas	lb.	.1375/	.15
Yellows, iron oxide	lb.	.115 /	.1225
Witcoblaks	lb.	.075 /	.37
Zopaque, anatase	lb.	.225 /	.235
Rutile	lb.	.245 /	.255

Dispersing Agents

Daxads	lb.	.08 /	.40
Tamol 731	lb.	.185 /	.1875

Fillers

Advaresin CXF	lb.	.49 /	.55
KF	lb.	.38 /	.44
A. F. D.	ton	26.50 /	60.00
Albacar 5950, 5960, 5970	ton	50.00 /	55.00
Aluminum Flake	ton	23.50 /	30.00
Anhydrous calcium sulfate, W-1320	ton	47.00 /	52.00
ASP 400	ton	24.00	
ASP 1300	ton	70.00	
Atomite	ton	32.50	
Barytes, No. 1	ton	45.00 /	65.75
Burgess Iceburg Pigment	ton	50.00	
Pigment No. 30	ton	37.00	
Cab-o-sil	lb.	.68 /	.75
Calcene NC	lb.	.036 /	.059
Calcene NC TM	lb.	.036 /	.059
	lb.	.0375/	.0625
Camel—CARB	ton	12.00	
—TEX	ton	20.00	
—WITE	ton	32.50	
Cotton flocks	lb.	.12 /	.32
Crown Clay	ton	14.00	
Dixie Clay	ton	14.00 /	34.50
Duramite	ton	20.00	
Edgar ASP 200	ton	43.00	
900	ton	18.50	
1300	ton	80.00	
Harwick fillers:			
Clays, Champion	ton	14.00	
Harwick	ton	14.50 /	57.00
Flock, white	lb.	.11 /	.28
Colored	lb.	.11 /	.19
Magnesium carbonate	lb.	.105 /	.13
Magnesia, tech.	lb.	.105 /	.12
Mica, Silversheen	lb.	.08 /	.0875
Pecan shell flour	ton	80.00 /	100.00
Stan white 325	ton	10.50 /	12.00
Walnut shell flours:			
100W, 200WD	ton	46.00 /	56.00
100WD	ton	40.00 /	50.00
200W	ton	56.00 /	66.00
200WB	ton	59.00 /	69.00
325W	lb.	70.00 /	80.00
Hi-Sil 101	lb.	.10 /	.155
233	lb.	.09 /	.105
Hydrite	ton	$22.50	
Flat	ton	22.50	
PD-10	ton	46.50	
Kalite	ton	50.00 /	65.00
Kaolloid	ton	10.50	
Laminar	lb.	.015	
Maglite	lb.	.2525/	.26
Marinco	lb.	.105 /	.13
McMamee Clay	ton	13.50 /	33.00
Multiflex MM	ton	110.00 /	125.00
Nytal 200L	ton	27.00 /	50.00
300	ton	37.00 /	60.00
Secco Clay	ton	12.00	
Silene EF	lb.	.06 /	.105
Sno-Brite Clay	ton	12.50	
Snowflake	ton	20.00	
Sparmite	ton	80.00 /	105.00
Surtex MM	ton	37.00 /	52.00
Suspenso	ton	33.00 /	48.00
Tamms Satin Talc	ton	22.50 /	46.00
Velveteen R Silica	ton	23.00 /	28.00
Witcarb P	ton	110.00 /	140.00
R	ton	120.00 /	150.00
Regular	ton	56.75 /	85.00
Wollastonite F-1	ton	23.00 /	25.00
P-1	ton	25.00 /	27.00

Finishes

Logoquant colors	gal.	3.25 /	6.30
Toy gloss, acetate	gal.	2.35 /	4.30
Metal	gal.	2.45 /	4.10
Polystyrene	gal.	2.45 /	4.70

Flame-Proofing Agents

IC-776 Antimony Concentrate	lb.	.495 /	.51
M&T Antimony oxide	lb.	.27 /	.285

Glass Reinforcements

Chrome 60-end Roving:			
FBF-7.1, -7.3	lb.	.40 /	.44
FBF-7.5, -7.7	lb.	.42 /	.46
Garan 60-end Roving:			
FBF-7.2, -7.4	lb.	.42 /	.46
FBF-7.6, -7.8	lb.	.44 /	.48
Vitron 60-end Roving:			
VR-12	lb.	.48 /	.52

Lubricants

Advawax 280	lb.	.365 /	.39
Baselube	qt.	2.50 /	4.00
DC-36 Emulsion	lb.	1.36 /	2.50
Garalease 915	gal.	3.80 /	4.50
GE silicone-emulsions	lb.	1.22 /	1.40
HSC #35, 362, 515	lb.	1.22	
IC-500	gal.	2.50	
-571	gal.	3.25	
-793-10	gal.	3.40	
Lunn-Lease	gal.	4.15 /	4.85
M-1 Mold Release	lb.	3.00 /	4.00
Metasap barium stearate	lb.	.37 /	.42
Calcium 627	lb.	.36 /	.41
Stearate	lb.	.35 /	.40
Magnesium stearate	lb.	.38 /	.43
ML-4 Separating Film	lb.	.30 /	.40
Mold-Ease Concentrate PCR	qt.	2.50 /	5.85
Mold Release 225	gal.	5.25 /	6.00
235	gal.	6.00	
Mold-Wiz	gal.	4.00 /	6.00
Part-A-Part	gal.	3.05 /	3.75
Partingkote 823	qt.	1.18 /	2.18
Prepoxy	gal.	7.20 /	12.80
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Releasor Wax No. 826	lb.	2.29	
Slide	20 oz.	1.25 /	2.00
Sprits	lb.	1.00 /	1.25
SS-452	gal.	2.80 /	4.90
Super King Bomb-Lube	20 oz.	1.75 /	2.50
Toplube	qt.	2.50 /	4.00
Vibrin-VPA Parting Agent	gal.	4.25 /	4.65

Mica

Mycalex 385 & 400, rods, 18 in. length		.90 /	3.35
Sheets, 14 x 18 inches		5.70 /	22.40
K, rods, 18-in. length		1.80 /	6.70
Sheets, 14 x 18 inches		11.40 /	44.80
Supramica 500, rods, 18-in. length		1.08 /	4.02
Sheets, 14 x 18 inches		6.84 /	26.88

Miscellaneous

Dutch Boy Bentone	lb.	.44 /	.60
Ben-A-Gel	lb.	.98 /	1.46
Metasap Water Proofing Agent 569	lb.	.21	
PMS Purging Compound	lb.	.35	
Ultra violet absorber #9	lb.	5.25 /	5.75

Plasticizers

Adipol 2EH, 10A, 810, XX	lb.	$0.40 /	.435
BCA	lb.	.43 /	.455
ODY	lb.	.45 /	.485
Admex 710	lb.	.325 /	.35
711	lb.	.345 /	.37
744, 745	lb.	.40 /	.425
Akron MP	lb.	.305 /	.0755
Battett dibutyl phthalate	lb.	.30 /	.335
Dimethyl phthalate	lb.	.275 /	.315
Plastixizer 136	lb.	.19 /	.235
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.32 /	.35
Cabflex DDA, DI-OA, DOA, ODA	lb.	.425 /	.455
DDP, DI-OP, DOP, ODP	lb.	.305 /	.335
Di-BA	lb.	.4325/	.4625
Di-OZ	lb.	.48 /	.51
HS-10	lb.	.44 /	.47
TCP	lb.	.345 /	.375
Chlorowax 40	lb.	.1525/	.1825
50	lb.	.1675/	.1875
70	lb.	.185 /	.25
70-S	lb.	.21 /	.275
LV	lb.	.1725/	.2025
Columbian Carbon butyl stearate	lb.	.2275/	.315
Capryl alcohol	lb.	.195 /	.30
Caprylene	lb.	.10 /	.205
Dibenzyl sebacate	lb.	.88 /	.965
Dibutyl phthalate, dihexyl phthalate	lb.	.30 /	.395
Dibutyl sebacate, CP	lb.	.64 /	.725
Dicapryl phthalate	lb.	.295 /	.38
Dicapryl sebacate, dioctyl sebacate	lb.	.58 /	.665
Dihexyl adipate	lb.	.40 /	.495
Dihexyl sebacate	lb.	.62 /	.705
Diisooctyl phthalate, dioctyl phthalate	lb.	.305 /	.40
Dimethyl sebacate	lb.	1.25 /	1.335
Harchemex	lb.	.24 /	.345
Harflex 300	lb.	.58 /	.675
325	lb.	.4325/	.52
500	lb.	.315 /	.41
Methyl hexyl ketone	lb.	.26 /	.365
Sebacic acid, CP	lb.	.70 /	.82
Purified	lb.	.64 /	.76
Conoco H-300	lb.	.06 /	.10
Darex DIBA	lb.	.4325/	.4625
DIBM	lb.	.32 /	.3475
DIBP	lb.	.30 /	.33
DODA, DIOA	lb.	.425 /	.455
DIDP, DIOP, DOP, DOP-HR, IOIDP	lb.	.305 /	.335
Dinopol 235	lb.	.355 /	.385
IDO	lb.	.305 /	.335
MOP	lb.	.325 /	.355
Dow Plasticizer No. 5	lb.	.315 /	.54
Resin 276-V2,-V9	lb.	.265 /	.325
Drapex 3.2	lb.	.40 /	.49
Drew DP-100, DP'200	lb.	.425 /	.46
DP-250	lb.	.435 /	.47
DP-316	lb.	.30 /	.335
DP-317	lb.	.5625/	.5975
DP-520	lb.	.4225/	.4575
SC	lb.	.44	
Dutch Boy Plasticizer NL-A10 (DBP)	lb.	.30	.33
NL-A20 (DOP), NL-A30 (DIOP)	lb.	.305 /	.335
NL-C20 (DOS)	lb.	.61 /	.63
NL-F21	lb.	.395 /	.425
NL-F31	lb.	.44 /	.47
NL-F41	lb.	.48 /	.51
NL-A54	lb.	.295 /	.325
Elastex 10-P, 28-P	lb.	.285 /	.32
18-P	lb.	.29 /	.325
20-A, 60-A	lb.	.40 /	.435
40-P, 48-P	lb.	.27 /	.305
50-B	lb.	.265 /	.30
80-P	lb.	.275 /	.31
90-P	lb.	.295 /	.33
DCHP	lb.	.59 /	.605
Ethox	lb.	.50 /	.525
Flexol 3GH	lb.	.44 /	.46
3G0	lb.	.53 /	.55
4G0	lb.	.325 /	.355
8N8	lb.	.355 /	.385
10-10, 810, CC-55, DOP	lb.	.305 /	.335
10-A, A-26	lb.	.425 /	.455
77-G, 426	lb.	.27 /	.30
B-400	lb.	.25 /	.28
R2H	lb.	.59 /	.595
T0F	lb.	.435 /	.475
Flexricin 66	lb.	.3275	
P-4		.30	
P-6	lb.	.37	
P-8	lb.	.32	
Good-rite GP-233, -235, 236	lb.	.40 /	.55
GP-261, -265, -266	lb.	.305 /	.455
Harflex 10	lb.	1.25 /	1.335
40	lb.	.64 /	.725
50, 80	lb.	.58 /	.665
60	lb.	.62 /	.705
90	lb.	.88 /	.965
120, 150	lb.	.305 /	.395
140, 160	lb.	.30 /	.39
180	lb.	.295 /	.38
220, 250	lb.	.425 /	.515
260, 280	lb.	.42 /	.51
300	lb.	.58 /	.67
500	lb.	.315 /	.405
Harchem butyl stearate	lb.	.2275/	.3125
Sebacic acid, CP	lb.	.67 /	.79
Purified	lb.	.59 /	.71
Kapsol	lb.	.3225/	.3525

Kessoflex 103	lb.	$0.36 /	.38
BCL	lb.	.355 /	.375
BCO	lb.	.345 /	.365
BCP	lb.	.33 /	.36
BO	lb.	.26 /	.28
BS	lb.	.23 /	.25
DBT	lb.	.61 /	.64
DIA	lb.	.44 /	.47
DIOA, DOA	lb.	.40 /	.43
MCO	lb.	.335 /	.355
MCS	lb.	.32 /	.34
TRA	lb.	.37 /	.40
KP-23	lb.	.29 /	.32
-90	lb.	.40 /	.435
-140	lb.	.46 /	.485
-201	lb.	.5825/	.5925
-220	lb.	.31 /	.345
-555	lb.	.46 /	.485
Kronisol	lb.	.33 /	.365
Kronitex AA, I, K-3, MX	lb.	.345 /	.38
Methox	lb.	.385 /	.41
Monoplex DBS	lb.	.64 /	.665
DCP	lb.	.2925/	.32
DOS	lb.	.58 /	.605
S-38	lb.	.215 /	.24
S-70	lb.	.3925/	.42
S-71	lb.	.45 /	.475
Monsanto dibutyl phthalate	lb.	.30 /	.33
Diethyl phthalate	lb.	.25 /	.28
Dimethyl phthalate	lb.	.275 /	.305
Diphenyl phthalate	lb.	.5175/	.5375
DIDA, DOA	lb.	.425 /	.455
DIDP, DIOP, DOP	lb.	.305 /	.335
HB-20	lb.	.15 /	.17
HB-40	lb.	.22 /	.24
Orthonitrobiphenyl	lb.	.13 /	.15
Tricresyl phosphate	lb.	.33 /	.36
Triphenyl phosphate	lb.	.39 /	.40
Morflex P-50	lb.	.68 /	.71
Naugatuck decylbutyl phthalate	lb.	.27 /	.29
Dibutyl phthalate	lb.	.30 /	.33
Sebacate	lb.	.645 /	.67
Diisooctyl adipate, dioctyl adipate	lb.	.425 /	.455
Diisooctyl phthalate, dioctyl phthalate, Isooctyl decyl phthalate	lb.	.305 /	.335
Dinonyl adipate	lb.	.445 /	.475
Dioctyl sebacate	lb.	.585 /	.61
Epoxy plasticizer	lb.	.335 /	.36
Tricresyl phosphate	lb.	.345 /	.375
Ohio-Apex butyl oleate	lb.	.2325/	.265
Stearate	lb.	.22 /	.255
Diallyl phthalate	lb.	.49 /	.525
Dibutyl phthalate	lb.	.30 /	.335
Di-Carbitol phthalate	lb.	.40 /	.425
Diisobutyl adipate	lb.	.41 /	.445
Diisodecyl phthalate	lb.	.305 /	.34
Dioctyl phthalate	lb.	.305 /	.34
D.I.O.P.	lb.	.305 /	.34
Tributyl phosphate	lb.	.50 /	.535
Ohopex Q-10	lb.	.295 /	.33
R-9	lb.	.3525/	.3775
Paraplex 5-B	lb.	.29 /	.3475
AL-111	lb.	.32 /	.3275
G-20	lb.	.76 /	.7675
G-25	lb.	.76 /	.77
G-40	lb.	.4825/	.51
G-50	lb.	.39 /	.4175
G-53	lb.	.4325/	.46
G-60, -61	lb.	.3325/	.36
G-62	lb.	.3525/	.38
RG-2	lb.	.41 /	.6575
RG-7	lb.	.33 /	.335
RG-8	lb.	.505 /	.5125
RG-10	lb.	.52 /	.5275
Pfizer acetyl tributyl citrate, tech	lb.	.32 /	.57
Acetyl triethyl citrate, tech.	lb.	.36 /	.57
Triethyl citrate	lb.	.4575/	.58
Plasticizer 1	lb.	1.17 /	1.37
Plasticizer 120	lb.	.44 /	.49
Plastoflex #3	lb	.52 /	.57
#520	lb.	.36 /	.435
D B E	lb.	.50 /	.55
MGB	lb.	.29 /	.37
VS	lb.	.3575/	.3975
Plastolein 9050 DHZ	lb.	.52 /	.56
9055 DGP	lb.	.28 /	.32
9057 DIOZ	lb.	.455 /	.50
9058 DOZ	lb.	.455 /	.50
9250 THFO	lb.	.3575/	.4025
9404 TGP	lb.	.3725/	.4175
9715 & 9720 Polymeric	lb.	.365 /	.41
Polycizer 162	lb.	.285 /	.32
332, 532, 632	lb.	.40 /	.43
562	lb.	.29 /	.325
662, 662-BPA	lb.	.295 /	.33
Polycon #7, 9, 10, 11	lb.	.305 /	.335
#30	lb.	.30 /	.33
#31	lb.	.27 /	.30
#40	lb.	.245 /	.275
PX-104	lb.	.30 /	.33
-108, -118, -120, -138	lb.	.305 /	.335
-114	lb.	.27 /	.30
-208, -220, -238	lb	.425 /	.455
-404	lb.	.645 /	.67
-438	lb.	.585 /	.61
-800	lb.	.325 /	.35
-917	lb.	.33 /	.36
Pycal 40	lb.	.3875/	.4375
60	lb.	.60 /	.635
62	lb.	.80 /	.835
94	lb.	.3275/	.3775
140	lb.	.35 /	.40
170	lb.	.275 /	.325
194	lb.	$0.2775/	.3275
R C Plasticizers:			
B-17	lb.	.21 /	.33
BD-8	lb.	.38 /	.50
BIDP	lb.	.27 /	.42
DBP	lb.	.30 /	.44
DIDA, DIOA, DOA	lb.	.425 /	.56
DIDP, DIOP, DOP, ODP	lb.	.305 /	.45
DIOS, DOS	lb.	.58 /	.71
O-16	lb.	.275 /	.395
TG-8	lb.	.31 /	.43
TG-9	lb.	.41 /	.53
Santicizer 1-H	lb.	.50 /	.51
3	lb.	.46 /	.47
8	lb.	.43 /	.44
9	lb.	.39 /	.42
140	lb.	.33 /	.36
141	lb.	.34 /	.37
160	lb.	.25 /	.28
601	lb.	.32	
602	lb.	.305	
B-16	lb.	.4875/	.4975
E-15	lb.	.5075/	.5375
M-17	lb.	.4275/	.4575
Staflex AX	lb.	.43	
BR	lb.	.26 /	.29
CP	lb.	.28 /	.31
DBES, DOS	lb.	.61 /	.635
DIOA, ODA	lb.	.435 /	.465
DIOP, DOP, MP	lb.	.305 /	.335
DOZ	lb.	.48 /	.5075
IXA	lb.	.32 /	.35
KA	lb.	.36 /	.3875
KD	lb.	.44 /	.4675
Witcizer #100	lb.	.26 /	.27
#101	lb.	.31 /	.32
#200	lb.	.195 /	.205
#201	lb.	.235 /	.245
#300	lb.	.30 /	.33
#312, 313	lb.	.305 /	.33
#412	lb.	.435 /	.465

Resins & Molding Compounds

Acrylic

Cadco cast rods	lb.	1.42 /	6.96
Polished	lb.	1.58 /	7.16
Machined rods	ft.	22.00 /	89.54
Tubes	lb.	1.39 /	5.76
Polished	lb.	1.51 /	5.99
Colors	lb.	1.62 /	5.99
Pearl	lb.	1.99 /	6.76
Lucite injection molding powders:			
Colorless, transparent	lb.	.55	
Std. colors	lb.	.59 /	1.00
Stock colors	lb.	.59 /	.84
Granular Powders for compression & extrusion	lb.	.51 /	.75
Plexiglas molding powders:			
Colorless	lb.	.55 /	.80
Colors, stock	lb.	.59 /	.84
Custom	lb.	.59 /	1.00
Sheets, Types I-A & II			
Colorless	sq. ft.	.80 /	22.18
Colors	sq. ft.	.88 /	1.10
Type R, Colorless	sq. ft.	.60 /	12.64
Colors	sq. ft.	.69 /	1.07
Polycast 1	sq. ft.	.80 /	2.40

Alkyd

Plaskon foundry resin 580-11L	lb.	.245 /	.275
Molding Compound, Type 411	lb.	.43 /	.60
Type 413, 417	lb.	.57 /	.74
Type 420 black	lb.	.44 /	.695
Type 422 colored	lb.	.51 /	.695
Mottle	lb.	.52 /	.705
Natural	lb.	.49 /	.60
Type 430	lb.	.34 /	.50

Cellulosic

Cellulose acetate:			
Ampacet Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III			
Colors	lb.	.50 /	.59
Metallic	lb.	.63 /	.71
Pearl	lb.	.59 /	.68
Phosphorescent	lb.	.80 /	.89
Celanese film rolls			
Clear	lb.	.64 /	.87
Colors	lb.	.88 /	1.74
Sheets			
Clear	M. sq. in.	.032 /	.107
Colors	M. sq. in.	.042 /	.141
Forticel, plain colors	lb.	.63 /	.71
Reprocessed blacks	lb.	.51 /	.58
Lumarith molding cmpds.,			
Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III	lb.	.36 /	.45
Sheeting, extruded, non-stock			
Clear	M. sq. in.	.14 /	1.89
Colors	M. sq. in.	.16 /	2.07
Stock, clear	M. sq. in.	.14 /	1.62
Colors	M. sq. in.	.16 /	1.62
Cast, rolls			
Matte	M. sq. in.	.179 /	.648
Tinted	M. sq. in.	$0.239 /	.708
Sheets, clear	M. sq. in.	.141 /	1.52
Matte	M. sq. in.	.203 /	.788
Tinted	M. sq. in.	.255 /	1.72
Hercocel A, extrusion & injection	lb.	.50 /	.65
Injection, std. colors	lb.	.46 /	.61
Special colors	lb.	.42 /	.45
Tenite Acetate, Group 1	lb.	.50 /	.59
Group 2	lb.	.46 /	.55
Group 3	lb.	.41 /	.51
Group 4	lb.	.38 /	.49
Group 5	lb.	.65 /	.75
Cellulose acetate butyrate:			
Tenite butyrate	lb.	.62 /	.71
A pearls	lb.	.72 /	.81
Blacks, reprocessed	lb.	.50 /	.58
Ethyl cellulose:			
Dyeform 720, 721	lb.	1.29 /	1.52
Ethocel P. G.	lb.	.72 /	.80
Bulk, reg.	lb.	.66 /	.81
Std., 7 cps.	lb.	.71 /	.86
Hercocel E	lb.	.72 /	.88

Epoxy

Araldite 502, 6010, 6020	lb.	.80 /	.995
504	lb.	.77 /	.965
551, 6060	lb.	.75 /	.95
6030, 6040	lb.	.885 /	.995
Bakelite ERL series	lb.	.80 /	.995
Epocast 2, 3, 5	lb.	1.33 /	1.77
4-B-2, 4-B, 4-C, 4-C-T, 4-D, Paste	lb.	1.15 /	1.55
Epon 562	lb.	1.52 /	1.77
815	lb.	.80 /	.99
820, 828	lb.	.80 /	.97
834	lb.	.855 /	1.00
864	lb.	.91 /	1.06
864-C-75	lb.	.73 /	.85
1001	lb.	.615 /	.85
1004	lb.	.595 /	.6025
1007	lb.	.605 /	.6125
1009	lb.	.69 /	.6975
Furane CN-502	lb.	1.33 /	1.77
Jet-Kote (with cat.)	gal.	7.50 /	10.00
Maraset 602, 610, 610V, 612B, 613, 648	lb.	1.25 /	1.70
604A, 607	lb.	1.17 /	1.60
608	lb.	1.17 /	1.65
614A, 631A, 618A, 640	lb.	1.32 /	1.77
645	lb.	1.15 /	1.70
Rezolins A & B	lb.	1.29 /	1.74
Toolplastik packages:			
L-900, L-930	lb.	1.59 /	2.29
L-902	lb.	1.69 /	1.84
L-904	lb.	1.54 /	2.19
L-910	lb.	1.94 /	2.34
L-914	lb.	1.83 /	2.19
L-931	lb.	1.75 /	1.99
L-940	lb	2.05 /	2.29

Fluorocarbon

Bakelite FGBB-33789, FGEB-34790, FXMA-50590, FXMB-50344	lb.	9.00 /	10.00
FGEB-32788, FXMB-50090	lb.	12.00 /	14.00
FYTD	lb.	11.00 /	13.00
FYTH, FYTS	lb.	8.50 /	9.50
Kel-F Grade 270, 300 High density	lb.	9.00 /	10.00
Low density	lb.	8.50 /	9.50
Grade 300-P25	lb.	10.00 /	11.00
Polyfluoron, high density crystals & pellets	lb.	9.00 /	9.50
Colors	lb.	9.50 /	10.00
Low density powder	lb.	8.50 /	9.00
Dispersion grade	lb.	10.50 /	11.00
Teflon powder, dispersion	lb.	7.00 /	7.75
Fine	lb.	9.50 /	11.00
General	lb.	5.10 /	5.75
Tape cylinder	lb.	5.35 /	6.00

Melamines

Fiberite 2015 (black & pastels)	lb.	.57 /	.62
Pelleted	lb.	.61 /	.66
Cymel 402	lb.	.51 /	.53
404R, 404T	lb.	.85 /	.95
405	lb.	.45 /	.52
428	lb.	.48 /	.55
430	lb.	.465 /	.535
440	lb.	1.10	
480	lb.	.265 /	.315
1077, 1079	lb.	.45 /	.75
Ungranulated	lb.	.43 /	.73
1500	lb.	.42 /	.55
1502	lb.	.45 /	.58
3020	lb.	.57 /	.72
3024-A	lb.	.67	
3135	lb.	.85 /	1.05
3136	lb.	1.05 /	1.15
P-592, -592-A	lb.	.65 /	.75
Plaskon	lb.	.44 /	.75

Phenolic

91-LD	lb.	1.50 /	2.50

...ires PL-50	lb.	$0.215	
UP-11	lb.	.2325	
...kelite general purpose	lb.	.187 /	.3525
BMG-5000	lb.	.19 /	.30
Colors	lb.	.2375/	.435
Chem. resist.	lb.	.23 /	.40
Electrical Insul.	lb.	.2725/	.4125
Heat resist.	lb.	.19 /	.35
Impact resist.	lb.	.24 /	.4025
...rrett foundry resins, liquid	lb.	.2125/	.2425
Powdered	lb.	.27 /	.355
Insulation resins	lb.	.15 /	.175
Molding resin 313, 314, 317	lb.	.27 /	.285
316	lb.	.295 /	.31
1502, -3, -4, -5, R-110R	lb.	.25 /	.265
R-114	lb.	.285 /	.30
...rfoam 107, 114	lb.	.55 /	.82
...racor 151	lb.	.215 /	.235
191	lb.	.13 /	.16
...rez, heat resist.	lb.	.19 /	.245
Impact resist.	lb.	.24 /	.63
Insulation	lb.	.21 /	.305
Non-Bleed	lb.	.19 /	.195
Special	lb.	.19 /	.665
Std.	lb.	.19 /	.245
...rite GP	lb.	.195 /	.24
HR	lb.	.191 /	.3025
IM	lb.	.24 /	.415
SG	lb.	.195 /	.3575
...rform	lb.	1.10 /	1.35
...berite 1078	lb.	.42 /	.43
1087, 1165, 1270, 1271, 1330, 1332, 1347, FM 1132, FM 3510	lb.	.39 /	.395
1153	lb.	.455 /	.46
1167	lb.	.3875/	.3925
1340	lb.	.4275/	.4325
1346	lb.	.44 /	.4475
4010	lb.	.68	
4020	lb.	.815 /	.82
FM 926	lb.	.43 /	.435
927	lb.	.41 /	.415
1914	lb.	.375 /	.38
1957	lb.	.445 /	.45
1996	lb.	.375 /	.38
10365	lb.	.5225/	.5275
11547	lb.	1.05 /	1.06
11678	lb.	.52 /	.525
14111	lb.	.415 /	.42
17067	lb.	.851 /	.82
17610	lb.	1.05 /	1.06
...berite 1078	lb.	.425 /	.435
1087, 1165, 1270, 1271, 1330, 1332, 1347, 1389, FM-1132, FM-3510, FM-3515	lb.	.395 /	.40
1153 (red only)	lb.	.46 /	.465
1167	lb.	.3925/	.3975
1333, FM-10365, FM-11678	lb.	.67 /	.675
1346, FM-927	lb.	.415 /	.42
1346 (red only)	lb.	.445 /	.452
4030-190	lb.	.78 /	.81
4031	lb.	.625 /	.63
FM-926	lb.	.435 /	.44
FM-1132 (pellets), FM-14111	lb.	.42 /	.425
FM-1914, FM-1996	lb.	.38 /	.385
FM-11547, FM-17610	lb.	1.07 /	1.08
FM-11679	lb.	1.29 /	1.30
FM-17067	lb.	.83 /	.835
G-E 12368, 12374, 12392 shell molding resins	lb.	.26 /	.35
12401		.2975	
12408, 12460, 12486, 12490, 12491, 12493, 12853, 12875, 12883, 12885, 12886, 12900, 12901	lb.	.195 /	.20
12410, 12420	lb.	1.50	
12432	lb.	.395	
12433	lb.	.555	
12435	lb.	.24	
12439, 12466	lb.	.265	
12444	lb.	.425	
12462	lb.	.505	
12463	lb.	.405	
12467	lb.	.51	
12487, 12489, 12884, 12887	lb.	.355	
12494	lb.	.375	
12495	lb.	.245	
12808	lb.	.49	
12809	lb.	.65	
12817, 12882	lb.	.205 /	.21
12841	lb.	.2425	
Loven LHR-401, -403	lb.	.225 /	.23
-407, -409	lb.	.60 /	1.00
-408	lb.	.25 /	.255
LI-201	lb.	.39 /	.40
-207	lb.	.475 /	.48
-209	lb.	.60 /	1.00
-212	lb.	.425 /	.43
LM-110, -119	lb.	.19 /	.195
-101	lb.	.24 /	.245
-116	lb.	.255 /	.26
-117	lb.	.225 /	.23
-118	lb.	.1975/	.2025
LMI-301	lb.	.2525/	.2575
-303	lb.	.345 /	.35
-304	lb.	.60 /	1.00
-307	lb.	.3075/	.3125
LMM-801, -803	lb.	.2125/	.2175
-804, -811	lb.	.245 /	.25
-807	lb.	.215 /	.22
Marblette 76, 77	lb.	.50 /	.60
Foam resin 1076	lb.	.50 /	.60
Plenco foundry resins	lb.	.27 /	.35
Molding cmpds. gen. purpose	lb.	$0.185 /	.235
Heat resist.	lb.	.19 /	.24
Improved impact	lb.	.225 /	.28
Min. bleed	lb.	.185 /	.195
Radio & TV	lb.	.20 /	.215
Stock	lb.	.205 /	.34
R-72S casting resin	lb.	.46 /	.74
Reilly general purpose	lb.	.195 /	.20
Heat & impact resist.	lb.	.20 /	.205
Resinox molding compounds:			
Gen. purpose & heat resist	lb.	.205 /	.215
Impact	lb.	.255 /	.3225
Low elec. loss	lb.	.31 /	.365
Special grade	lb.	.215 /	.255
Rogers phenolic molding compounds:			
RX 425	lb.	.29 /	.295
Special colors	lb.	.34 /	.405
RX 428	lb.	.355 /	.36
Special colors	lb.	.42 /	.465
RX 429	lb.	.365 /	.37
Special colors	lb.	.395 /	.48
RX 431	lb.	.4125/	.4175
Special colors	lb.	.455 /	.55
RX 438	lb.	.4675/	.4725
RX 441, 455	lb.	.32 /	.325
RX 442	lb.	.3475/	.3525
RX 447	lb.	.5025/	.51
RX 448	lb.	.355 /	.36
RX 458	lb.	.38 /	.385
RX 469	lb.	.365 /	.37
RX 470, 480	lb.	.40 /	.405
RX 478, 488	lb.	.415 /	.43
RX 525, 545	lb.	.29 /	.295
RX 530	lb.	.4125/	.4175
Special colors	lb.	.42 /	.475
RX 547	lb.	.37 0	.375
RX 625	lb.	.395 /	.40
RX 628	lb.	.455 /	.46
Schenectady shell mold resins	lb.	.26 /	.28
Synvar molding compounds, PM series	lb.	.205 /	.2625
Synvaren 640	lb.	.30 /	.335
920	lb.	.21 /	.245
935	lb.	.195 /	.23
9203, 9203A	lb.	.173 /	.208
Synvaren liquid industrial resins:			
675	lb.	.29 /	.325
920	lb.	.21 /	.245
CP-66	lb.	.19 /	.225
PBL-2	lb.	.33 /	.365
PBL-218S	lb.	.27 /	.305
Synvarite GW-1000	lb.	.34 /	.36
GW-1080, PBL-F, PBL-718	lb.	.37 /	.39
GW-2400	lb.	.375 /	.395
PBL-100	lb.	.31 /	.33
PBL-108FF	lb.	.38 /	.40
PBL-210, PBL-3301	lb.	.36 /	.38
PBL-410	lb.	.33 /	.35
PBL-3311	lb.	.35 /	.37
PNL-12HL/11, PNL-156HL/24	lb.	.3025/	.3225
PNL-159H, PNL-169H	lb.	.29 /	.31
PNL-169PD, PNL-179PD	lb.	.28 /	.30
PNL-355PD	lb.	.315 /	.335
PNL-1279HL	lb.	.2875/	.3075
PT	lb.	.32 /	.34
Toolplastik No. 8000	lb.	.48 /	.72

Polyamide

Fiberfil Nylon G, natural	lb.	1.70 /	1.90
Standard colors	lb.	1.80 /	2.20
G.M.I. Polyamide 115	lb.	.64 /	.77
Nylatron G, GS	lb.	1.75 /	2.00
Versamid 115	lb.	.66 /	.89
Zytel molding powder	lb.	1.435 /	1.60

Polyesters

Acme 1-501	lb.	.82 /	.93
1-501A	lb.	.87 /	.98
1-503	lb.	2.75 /	3.50
1-510	lb.	.89 /	1.00
Atlac 363E-02Z, -12Z	lb.	.66 /	.69
-32Z	lb.	.68 /	.71
382E	lb.	.57 /	.60
FP	lb.	.66 /	.69
Bakelite Polyester resins	lb.	.35 /	.75
Celanese polyesters:			
CEL-101, Marcothix 1, 3	lb.	.50 /	.565
Marcothix 5, 7, 8	lb.	.46 /	.525
MR-28C, -28V, -37C, -37CX	lb.	.33 /	.395
MR-28CS	lb.	.35 /	.415
MR-28H, -41R	lb.	.36 /	.425
MR-28R, -36R	lb.	.34 /	.405
MR-28RL, -37RL	lb.	.355 /	.42
MR-30C	lb.	.44 /	.505
MR-31C, -31V	lb.	.37 /	.435
MR-33C	lb.	.53 /	.595
MR-40R	lb.	.38 /	.445
Diall 50-01	lb.	2.90 /	3.00
50-51	lb.	3.25 /	3.50
50-52	lb.	3.50	
51-01	lb.	.87 /	.98
52-01	lb.	2.25 /	2.50
52-20-30	lb.	1.50	
Diall 50-01, 50-51, 50-52	lb.	2.75 /	3.50
51-01	lb.	.87 /	.98
52-01	lb.	1.95 /	2.50
52-20-30	lb.	1.30 /	1.50
Fibercore 1000, 2000	lb.	.50 /	.65
3000	lb.	$0.55 /	.70
G-E polyesters			
AR 401	lb.	.35 /	.365
AR 403, 480	lb.	.34 /	.355
AR 403 LS, 480 LS	lb.	.355 /	.37
AR 493	lb.	.40 /	.415
AR 499	lb.	.435 /	.45
AR 501	lb.	.455 /	.47
Hetron	lb.	.43 /	.485
IC-312, -400, -514, -548, -625, -730, -800	lb.	.35 /	.385
-312-2	lb.	.365 /	.38
-336, -382, -706	lb.	.37 /	.385
-401	lb.	.44 /	.455
-420	lb.	.355 /	.37
-433	lb.	.38 /	.395
-636, -670	lb.	.48 /	.495
-638, -689	lb.	.55 /	.565
-670-2	lb.	.50 /	.515
-671	lb.	.405 /	.42
Filled resins	lb.	.255 /	.54
Laminac 4110	lb.	.33 /	.345
4111	lb.	.45 /	.465
4116	lb.	.33 /	.345
4120	lb.	.39 /	.405
4123, 4128	lb.	.34 /	.355
4134	lb.	.46 /	.475
4146	lb.	.43 /	.445
4192	lb.	.355 /	.37
4202	lb.	.55 /	.565
Mylar, rolls, types A & C	lb.	2.50 /	4.80
Type D	lb.	3.00 /	3.30
Sheets, type A	M. sq. in.	.09 /	1.11
Type C	M. sq. in.	.09 /	.15
Type D	M. sq. in.	.53 /	1.34
Plaskon 911, 920	lb.	.55 /	.665
941, 942, 951, 9411	lb.	.35 /	.465
943	lb.	.41 /	.525
9404	lb.	.365 /	.48
9406	lb.	.355 /	.465
9500, 9510, 9511	lb.	.35 /	.465
9600	lb.	.44 /	.555
Polycast 2	sq. ft.	1.89 /	5.18
3	sq. ft.	1.08 /	18.00
6	sq. ft.	.66 /	3.10
7	sq. ft.	.72 /	7.18
CR-39	sq. ft.	1.25 /	20.00
Pre-Imp	lb.	.68 /	.85
Thermaflow 100, 200, 300	lb.	.48 /	.82
400, 500	lb.	.52 /	.87
1,000, 2,300	lb.	.34 /	.55
2,400	lb.	.36 /	.58
Vibrin 114, 117, 152, 154	lb.	.34	
115A	lb.	.38	
121	lb.	.46	
135	lb.	3.00	
142	lb.	.50	
151	lb.	.35	
152LS-4	lb.	.355	
153	lb.	.40	
X-1633-A	lb.	.49	
X-1636-W	lb.	.585	

Polyethylene

A-C No. 6, 617	lb.	.30 /	.37
No. 6A, 7, 617A	lb.	.35 /	.42
No. 615, G-201	lb.	.38 /	.45
No. 629	lb.	.40 /	.47
No. 729	lb.	.45 /	.52
Alathon	lb.	.41 /	.505
Bakelite DE Series	lb.	.43 /	.725
DYGT	lb.	.54 /	.69
DYLT, DYNF, DYNH	lb.	.41 /	.59
DYNJ	lb.	.44 /	.62
DYNK	lb.	.45 /	.63
Catalin 15-5	lb.	.41 /	.59
Celanese polyethylene sheeting:			
Extruded rolls, 44 in. wide	lb.	.56 /	1.12
Sheets, 44 x 60 in.	sheet	.83 /	8.76
Petrothene 100, 110, 200, 201, 202, 203, 210, 211, 213, 301, 312, 322	lb.	.41 /	.51
310, 320	lb.	.45 /	.55
310-BK-3, 320-BK-3, 320-BK-½, 320 colors	lb.	.53 /	.63
311, 321	lb.	.43 /	.53
311-BK-3, 312-BK-3, 322-BK-3 322-BN-1	lb	.375 /	.48
311-BK-½, 321-BK-3, 321-BK-½, 321-BN-1	lb.	.46 /	.56
321 colors	lb.	.50 /	.60
560	lb.	.38 /	.48
Poly-Eth 1003	lb.	.45 /	.59
1004, 1005, 1007, 1008.5, 2005, 2007, 2037, 2205, 2215, 2235	lb.	.41 /	.55
3215	lb.	.35 /	.515
4005	lb.	.43 /	.57
5003	lb.	.53 /	.68
5005	lb.	.375 /	.515
Reynolon 1000, P series	lb.	.60 /	.80
Tenite Group 1	lb.	.41 /	.45
Group 2	lb.	.43 /	.47
Group 3	lb.	.46 /	.50
Group 4	lb.	.39 /	.43
Group 5, 6	lb.	.50 /	.72
Group 7	lb.	.60 /	.82
Group 8	lb.	.70 /	.92

Silicone

Bakelite GMGA-5001, -5002	lb.	2.75 /	3.10
5003	lb.	4.00 /	4.35
5004	lb.	5.40 /	5.75

Styrenes

Ampacet, crystal	lb.	$0.315 /	.385
Colors, std.	lb.	.345 /	.365
Special	lb.	.345 /	.75
Pearl	lb.	.41 /	.75
Phosphorescent	lb.	.695 /	1.00
Tinsel	lb.	.41 /	.67
Confetti	lb.	.51 /	.70
Bakelite BMC series, nat.	lb.	.45 /	.685
Colors	lb.	.50 /	.735
BMS, SMD series, crystal	lb.	.295 /	.31
Colors, std,	lb.	.335 /	.35
Special	lb.	.335 /	.52
RMD series, nat.	lb.	.45 /	.685
Colors	lb.	.50 /	.735
TGD series	lb.	.33 /	.35
Colors, std.	lb.	.36 /	.38
Special	lb.	.36 /	1.00
TMD series	lb.	.33 /	.40
Colors, std.	lb.	.36 /	.43
Special	lb.	.36 /	1.00
Catalin, high impact, natural	lb.	.325 /	.355
Colors, std.	lb.	.355 /	.385
Special	lb.	.36 /	1.00
Medium impact, natural	lb.	.325 /	.355
Colors, std.	lb.	.355 /	.385
Special	lb.	.355 /	1.00
Regular grade, crystal	lb.	.305 /	.325
Colors, std.	lb.	.345 /	.365
Special	lb.	.345 /	1.00
Utility black	lb.	.18 /	.235
Cycolac compounds:			
Natural powders	lb.	.58 /	.66
Natural & std. color pellets	lb.	.65 /	.73
Darex Copolymer 3	lb.	.47 /	.67
43G	lb.	.39 /	.58
X34	lb.	.42 /	.61
Latices 3L	lb.	.415 /	.56
610L	lb.	.30 /	.46
3020	lb.	.32 /	.47
Dow Latex, polystyrene latices, styrene/	lb.	.30 /	.46
Resins PS-2&3	lb.	.25 /	.35
butadiene	lb.	.30 /	.46
Dylite, expandable beads	lb.	.50 /	.60
Fiberfil Styrene G, natural	lb.	.55 /	1.00
Standard colors	lb.	.65 /	2.00
Koppers, Fibertuff	lb.	.55 /	1.505
MC-185 series	lb.	.33 /	.355
-300 series	lb.	.33 /	1.005
-400 series	lb.	.355 /	1.005
Regular, crystal	lb.	.295 /	.315
Colors, std.	lb.	.335 /	.355
Special	lb.	.335 /	1.005
Pearl	lb.	.41 /	1.005
Phosphorescent	lb.	.695 /	2.005
Kralastic, std. colors	lb.	.50 /	1.10
Lustrex Hi-Flow 55, crystals	lb.	.295 /	.31
Hi-Test 88, std.	lb.	.36 /	.38
Special colors	lb.	.36 /	1.00
L, crystals	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
LHA, std.	lb.	.355 /	.375
Special	lb.	.355 /	1.00
Utility black, gen. purpose	lb.	.18 /	.185
High impact	lb.	.235 /	.24
Medium impact	lb.	.19 /	.195
Marbon resins	lb.	.39 /	.45
Plio-Tuf C75	lb.	.37 /	.40
G85	lb.	.52 /	.54
Polycast 4	sq. ft.	2.56 /	11.07
Styron 475, natural	lb.	.33 /	.35
Colors, std.	lb.	.36 /	.38
Special	lb.	.36 /	1.00
Sheets, std.	lb.	.55 /	.60
Special	lb.	.55 /	.62
480, natural black	lb.	.38 /	.40
Colors, std.	lb.	.41 /	.43
Special	lb.	.41 /	1.00
647, crystal	lb.	.305 /	.32
Colors, special	lb.	.345 /	1.34
66, 688, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
700, crystal	lb.	.295 /	.31
Colors, std.	lb.	.335 /	.35
Special	lb.	.335 /	1.00
777 colors, std.	lb.	.355 /	.375
Special	lb.	.355 /	1.00

Urea

Admirez Foundry Resins, SP-30	lb.	.27	
UP-50	lb.	.105	
Beetle C-4980 Brown	lb.	.1875/	.30
No fines granulation	lb.	.2075/	.32
T-298 Black	lb.	.1875/	.30
MUP series, powder	lb.	.30 /	.49
Special colors	lb.	.30 /	.59
Granules	lb.	.33 /	.52
Special colors	lb.	.33 /	.62
Plaskon molding cmpds.:			
Black & Brown	lb.	.1875/	.30
Other colors	lb.	.30 /	.62
Foundry resins, liquid	lb.	.10 /	.13
Powdered	lb.	.2325/	.2525
Syiplast molding cmpds., granules	lb.	.33	
Powder	lb.	.30	

Vinyls

Bakelite QG-5909	lb.	$0.35 /	.585
QG-5921	lb.	.41 /	.645
5924	lb.	.43 /	.665
QYNA, QYSM, QYSQ	lb.	.27 /	.47
QYNV	lb.	.30 /	.50
QYSJ	lb.	.28 /	.48
VG-1914, 1918	lb.	.37 /	.056
1985	lb.	.35 /	.585
5507	lb.	.31 /	.545
5544	lb.	.405 /	.64
5911	lb.	.315 /	.55
5980	lb.	.32 /	.555
7734	lb.	.28 /	.515
9031	lb.	.265 /	.50
9530	lb.	.275 /	.51
9960, 9970, 9980	lb.	.335 /	.57
VAGH	lb.	.55 /	.75
VMCH	lb.	.41 /	.61
VYDR, VYNW	lb.	.27 /	.47
VYHH	lb.	.32 /	.52
VYLF	lb.	.36 /	.56
VYNS	lb.	.44 /	.64
VYNV	lb.	.32 /	.52
Blacar No. BW-60	lb.	.315 /	.385
NEMA colors	lb.	.355 /	.425
No. BW-80	lb.	.405 /	.455
NEMA colors	lb.	.445 /	.495
No. PC white, ivory, black	lb.	.285 /	.335
Other colors	lb.	.325 /	.375
Darex Everplex A (wet wt.)	lb.	.21 /	.39
B (wet wt.)	lb.	.22 /	.40
G (wet wt.)	lb.	.21 /	.39
Copolymer Y (wet wt.)	lb.	.245 /	.28
PVA Emulsions (wet wt.)	lb.	.19 /	.355
Diamond PVC-45, -50	lb.	.38 /	.44
Dow PVC-100, -111	lb.	.38 /	.57
Exon 402A, 500, 905, 915, 925	lb.	.31 /	.51
450, 468R, 480	lb.	.35 /	.55
461	lb.	9.75	
468	lb.	.33 /	.53
470	lb.	.55	
471	lb.	.50	
654	lb.	.34 /	.54
Formvar	lb.	.865 /	1.03
Gelva emulsions	lb.	.19 /	.205
Granules	lb.	.4175/	.6175
Geon 101, 101EP, 103EP, 202	lb.	.27 /	.45
121	lb.	.30 /	.48
126	lb.	.28 /	.46
400X110	lb.	.41 /	.59
404HI	lb.	.37 /	.55
409, 426, 427, 428	lb.	.32 /	.50
503H (polyblend)	lb.	.425 /	.525
2042, 2046	lb.	.315 /	.55
Colors	lb.	.365 /	.60
6373	lb.	.345 /	.58
Colors	lb.	.395 /	.63
6461	lb.	.325 /	.56
Colors	lb.	.375 /	.61
8372	lb.	.33 /	.565
Colors	lb.	.38 /	.615
8539, 8726	lb.	.33 /	.565
Colors	lb.	.35 /	.585
8590, 8591, 8592, 8593, 8594, 8595	lb.	2.00 /	2.75
8600	lb.	.275 /	.51
Colors	lb.	.325 /	.56
8620	lb.	.27 /	.505
Colors	lb.	.32 /	.555
8630	lb.	.425 /	.66
Colors	lb.	.475 /	.71
8640	lb.	.35 /	.585
8650	lb.	.32 /	.555
8677	lb.	.435 /	.67
8700A, 8750	lb.	.425 /	.66
Colors	lb.	.455 /	.69
8720	lb.	.605 /	.84
8737	lb.	.33 /	.565
8740	lb.	.295 /	.53
8749	lb.	.29 /	.525
8800	lb.	.44 /	.675
8801	lb.	.275 /	.51
Colors	lb.	.325 /	.56
8802	lb.	.33 /	.565
Colors	lb.	.38 /	.615
8804	lb.	.29 /	.525
8807	lb.	.45 /	.685
8809	lb.	.37 /	.605
8810	lb.	.275 /	.55
8812, 8813, 8814, 8815	lb.	.315 /	.51
Geon Latex 151, 251	lb.	.26 /	.32
351	lb.	.32 /	.38
352	lb.	.28 /	.34
552, 652	lb.	.37 /	.43
450x167	lb.	.39 /	.45
576	lb.	.365 /	.405
Krene, film	lb.	.505 /	.655
Sheeting	lb.	.49 /	.645
Marvinols:			
NF-1005	lb.	.34 /	.625
NF-1055, 3520	lb.	.275 /	.56
NF-3020	lb.	.41 /	.645
NF-3025	lb.	.38 /	.665
NF-3040	lb.	.3375/	.6225
NF-3045, 3050	lb.	.37 /	.605
NF-3055	lb.	.285 /	.57
NF-3060	lb.	.29 /	.575
NF-3065	lb.	.30 /	.585
NF-3070, 3075, 3080	lb.	.265 /	.50
NF-3085, 3090, 3095	lb.	.29 /	.525
NF-3505, 3515	lb.	.36 /	.595
NF-3510	lb.	.34 /	.575
NF-4005	lb.	.44 /	.675
NF-4010, 4015, 4020	lb.	$0.42 /	
NF-5015, 5020	lb.	.40 /	
NF-5025	lb.	.33 /	
NF-5030	lb.	.29 /	
NR-6015	lb.	.39 /	
NR-6020	lb.	.39 /	
NR-7002, 7045, 7060	lb.	.50 /	
VR-10	lb.	.30 /	
VR-12, -20, -21, -22, -24, -30	lb.	.29 /	
VR-50	lb.	.32 /	
Opalon 300, 300FM	lb.	.31 /	
410	lb.	.34 /	
505	lb.	.35 /	
Inj. molding cmpds.	lb.	.29 /	
Profile extrusion cmpds.	lb.	.29 /	
Wire cmpds.	lb.	.29 /	
Plastiflex, std.	lb.	.90 /	
Novelty	lb.	1.15 /	
Pliovic AO (dispersion)	lb.	.30 /	
DB80V, DB90V, EDB90V	lb.	.27 /	
Latex 300	lb.	.30 /	
Reynolon, 4000 series	lb.	1.55 /	
Rolls, 1-mil	sq. yd.	.0625/	
Colors	sq. yd.	.0675/	
4-mil	sq. yd.	.215 /	
Colors	sq. yd.	.2375/	
16-mil	sq. yd.	.81 /	
Colors	sq. yd.	.86 /	
Satinflex	lb.	1.15 /	
Vygen 110, 120	lb.	.27 /	
1101, 1150	lb.	.425 /	
2201	lb.	.48 /	

Vinylidine

Dow Latex 744-B	lb.	.26 /	
Resin 565	lb.	.39 /	
Saran formulation 115, black, nat.	lb.	.39 /	
Colors	lb.	.44 /	
720 nat.	lb.	.41 /	
Colors	lb.	.46 /	
747 nat.	lb.	.395 /	
761 nat.	lb.	.39 /	
Colors	lb.	.44 /	
820 nat.	lb.	.42 /	
Colors	lb.	.47 /	
Latices	lb.	.45 /	
Resin F 120	lb.	.58 /	
F242	lb.	.64 /	

Solvents

Enjay acetone	lb.	.08 /	
Isopropyl acetate	lb.	.11 /	
Methylethyl ketone	lb.	.12 /	
Secondary butyl acetate	lb.	.1175/	
Butyl alcohol	lb.	.12 /	
Petrohol 91%	gal.	.37 /	
95%	gal.	.39 /	
99%	gal.	.41 /	

Stabilizers

Advastab B-13-P, BC-105, XBC-147	lb.	.75 /	
BC-12, C-77, E-82, XC-79, XC-143	lb.	.90 /	
BC-74, XBC-30	lb.	.70 /	
C-21	lb.	1.00 /	
CH-101, CH-201	lb.	.60 /	
JCX	lb.	.62 /	
L paste, Z-6	lb.	.65 /	
SN	lb.	.47 /	
T-10, T-52	lb.	1.90 /	
T-17M	lb.	2.95 /	
T-50LT	lb.	3.20 /	
T-7-2, T-671	lb.	2.67 /	
155	lb.	.69 /	
XE-98	lb.	.53 /	
Argus Mark C	lb.	.88 /	
E	lb.	.72 /	
M	lb.	.68 /	
PL	lb.	.63 /	
TT	lb.	.72 /	
WS	lb.	.98 /	
X	lb.	2.50 /	
XI	lb.	.87 /	
XV	lb.	.92 /	
XX	lb.	.58 /	
Barca 10	lb.	.75 /	
Baker barium ricinoleate	lb.	.70	
Calcium ricinoleate	lb.	.55	
Zinc vicinoleate	lb.	.60	
Dutch Boy Barinac	lb.	.70	
Calstar	lb.	.37	
Clarite A	lb.	.83	
B	lb.	.68	
CS-137	lb.	1.25	
DS-207	lb.	.55	
Dyphos	lb.	.58 /	
50A	lb.	.34	
Dythal	lb.	.395 /	
Leadstar	lb.	.39	
Lectro 60	lb.	.2525	
Normal lead maleate	lb.	.4475	
Normasal	lb.	.46	
Pearlescent pigment	lb.	1.00	
Plumb-O-Sil-A	lb.	.3075	

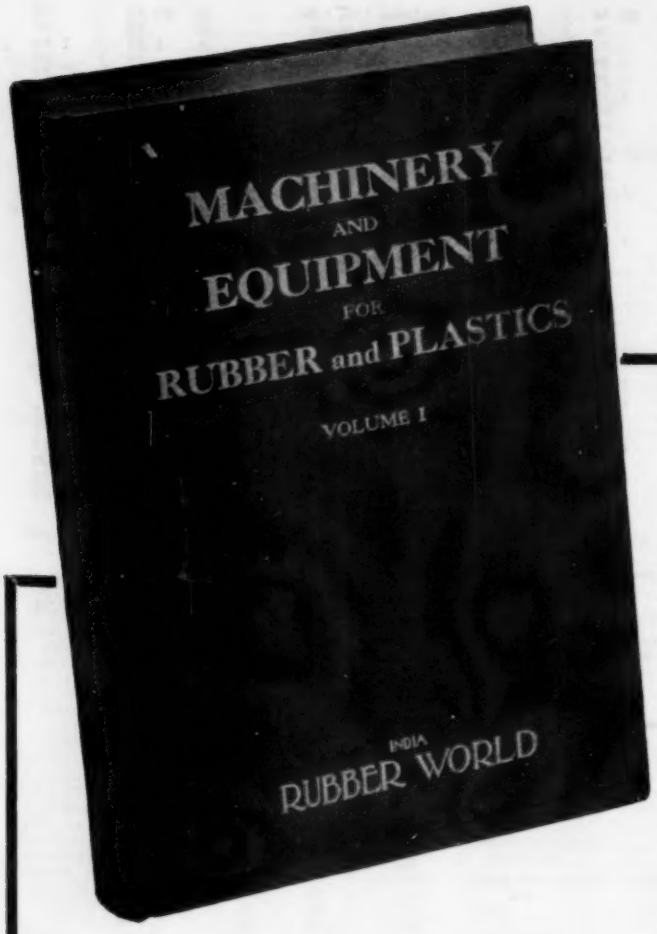
.....	lb.	$0.325	/ .37
.....	lb.	.3475	/ .375
ovinite A	lb.	.83	
ibase	lb.	.68	
.....	lb.	.275	
rimal	lb.	.2225	
o 182	lb.	.435	
.....	lb.	.70	/ .76
.....	lb.	1.31	/ 1.43
1, 900, 1820	lb.	.88	/ 1.00
.....	lb.	.28	/ .40
.....	lb.	.80	/ .92
IA	lb.	.47	/ .59
.....	lb.	.63	/ .75
1, 1972	lb.	2.50	/ 2.75
.....	lb.	3.25	
.....	lb.	.58	/ .70
.....	lb.	.91	/ 1.01
.....	lb.	1.30	/ 1.40
03	lb.	1.23	/ 1.33
06	lb.	.68	/ .80
12	lb.	.98	/ 1.10
25	lb.	.73	/ .85
40	lb.	.45	/ .57
76	lb.	.43	
thaw I-V-3	lb.	.68	
V-4	lb.	.66	/ .71
V-7	lb.	.85	/ .90
V-4	lb.	1.10	/ 1.15
V-7	lb.	1.30	
V-8	lb.	.80	/ .85
V-400	lb.	.41	
V-1	lb.	.49	
V-22	lb.	.90	/ .95
V-1	lb.	.95	/ 1.00
V-2	lb.	1.18	/ 1.23
V-4	lb.	1.10	/ 1.15
V-1	lb.	.80	/ .85
V-5	lb.		

8-V-100	lb.	$0.84	/ .89
9-V-1	lb.	.76	/ .81
12-V-5	lb.	.75	
22-V-1	lb.	1.28	
24-V-1	lb.	1.28	/ 1.33
28-V-2	lb.	1.18	
128-V-5	lb.	.86	
281-V-4	lb.	.90	
Merix AST Concentrate 1001	lb.	.355	/ 1.75
Metasap 613-A	lb.	.69	
613-B	lb.	.84	
613-C	lb.	1.06	
621	lb.	.88	
624	lb.	.75	
Cadmium stearate	lb.	1.40	/ 1.44
Fused stearates, calcium 602-A	lb.	.25	/ .30
Dibasic lead stearate ...	lb.	.56	
Lead 611	lb.	.32	/ .37
Lead stearate	lb.	.39	/ .44
Nuostable V-1	lb.	.54	/ .59
V-2	lb.	.39	/ .44
V-10	lb.	.70	/ .75
V-20	lb.	1.30	/ 1.35
V-21	lb.	1.29	/ 1.34
V-30	lb.	.90	/ .95
V-31	lb.	.80	/ .85
V-40	lb.	1.18	/ 1.23
V-42	lb.	.65	/ .70
V-43	lb.	.75	/ .80
V-44	lb.	.90	/ .95
V-45	lb.	1.10	/ 1.15
V-50	lb.	.49	/ .54
V-60	lb.	.37	/ .42
V-70	lb.	.68	/ .73
V-80	lb.	2.80	/ 2.85
V-81	lb.	2.90	/ 2.95
Permyl A	lb.	.45	/ .57

Stabelan 110, 120	lb.	$0.65	/ .75
115, HR paste	lb.	.85	/ .95
E	lb.	1.35	/ 1.50
HR-50	lb.	.75	/ .90
HR liquid	lb.	.65	/ .75
Powder	lb.	.95	/ 1.05
XL	lb.	.55	/ .65
Staflex QMXA	lb.	.70	
50% in DOP	lb.	.52	
OY	lb.	1.00	/ 1.20
Stayrite #10	lb.	.33	/ .37
#15	lb.	.54	/ .57
#20	lb.	.38	/ .42
#22	lb.	1.32	/ 1.34
#25	lb.	.36	/ .40
#70, 75, 80, 90	lb.	.69	/ .70
#229	lb.	.47	/ .50
P-10	lb.	.40	/ .44
Thermolite 12	lb.	2.00	/ 2.25
13	lb.	3.10	/ 3.75
15	lb.	4.13	
17	lb.	2.45	/ 2.75
20	lb.	2.95	/ 3.25
39	lb.	2.75	/ 3.25
91	lb.	3.00	
Vanstay C-73 S	lb.	.63	/ .65
HT	lb.	.90	/ .92
L	lb.	.33	/ .35
LN	lb.	.98	/ 1.00
R	lb.	.70	/ .72
Z	lb.	.67	/ .69

Wetting Agents

Advawet X-212	lb.	.50	/ .55
Poly-lube No. 4	qt.	1.45	/ 1.94



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